tab edizioni

The conventional and non conventional emergencies is a macro definition including all the events that can affect, directly or indirectly, the safety and the security at local, regional, national or international levels. The Covid-19 pandemic situation such as the Spanish flu, the Chernobyl accident such as the Fukushima's one, the chemical attack in Ypres such as the subway release of Sarin in Tokyo are just few example representing some of the historical recurrences that can be classified as natural, accidental, intentional or war related events or as biological, radiological/nuclear, chemical events. There are many aspects to consider in order to face those events and the related consequences: experts and technologies availabilities, national and international intervention and cooperation plans, prevention plans, education and training programs, research projects, emergency management plans, communication systems, recovery of normality, logistic, economical and legal aspects, business continuity and so on. It is indubitable that an emergency involve, directly or indirectly, the entire society. This is way this scientific & editorial project want to collect all the aspects related to the emergency, «CBRNe & Beyond» has the purpose to be a point of convergence of expertise, experiences and lessons learned to improve safety and security worldwide in order to reach the recovery of normality after an event.

CBRNe & Beyond

PASQUALE SPANÒ

CBRNe Threat

The Dual Use of Remotely Piloted Aircraft System

UNIVERSITÀ

Table of Contents

Index of Abbreviations

AED	Automated External Defibrillators
AI	Artificial Intelligence
ATC	Air Traffic Control
AUDROS	Autonomous Drone Service
BVLOS	Beyond Visual Line of Sight
CBRNe	Chemical, Biological, Radiological, Nuclear, and explosives
C-UAS	Counter Unmanned Aerial System
DDD	Dirty Dangerous Dull
DIY	Do It Yourself
DRONE	Dynamic Remotely Operated Navigation Equipment
GLONASS	Global Orbiting Navigation Satellite System
EASA	European Union Aviation Agency
EDF	Electricitè De France
EO/IR	Electro-Optical/InfraRed
ERSG	European Rpas Steering Group
ENAC	National Aviation Civil Authority (Ente)
FBI	Federal Bureau of Investigation
GPS	Global Position System

ICAO	International Civil Aviation Organization
IED	Improvised Explosive Device
INS	Inertial Navigation System
ISR	Intelligence Surveillance and Reconnaissance
ISTAR	Intelligence, Surveillance, Target Acquisition and Reconnaissance
LDS	Laser Detect System
LSS	Low, Small and Slow
MTOM	Maximum Take Off Mass
NATO	North Atlantic Treaty Organization
NSA	National Security Agency
OCT	Observation, Control, Tailing
ROCSAFE	Remotely Operated CBRNe Scene Assessment & Forensic Examination
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft System
RSTA	Reconnaissance, Surveillance, Target Acquisition
SES	Single European Sky
TIC	Toxic Industrial Chemical
TNI	Tactical Network Injector
UA	Unmanned Aircraft
UAS	Unmanned Aircraft System
UAV	Unmanned Aerial Vehicle
UVS	Unmanned Vehicle System
VIO	Visual Inertial Odometry
VLOS	Visual Line of Sight
VTOL	Vertical Take Off and Landing

Introduction

The topic of this thesis concerns the use of remotely piloted aircraft systems, more commonly called drones, in the context of the CBRN threat both to offend the population with possible attacks and as tools to counter this threat by anti-terrorism bodies. The choice of this theme was dictated by the fact that being an airplane pilot of the Italian State Police also qualified to pilot RPAS, I wanted to deepen the study of the latter devices and research the numerous applications that these ever-expanding technologies offer both in the civil and military field that in the context of the CBRNe threat and its contrast. The aim of my research was to highlight above all the dual use nature of remotely piloted aircraft systems which, in addition to offering a wide range of possible applications in the civil and military fields, lend themselves to being used by criminals or terrorist groups to bring terrorist actions, including CBRNe attacks. At the same time, I wanted to research, among the various applications that this ever-expanding technology offers, any current and future uses that could transform these devices into tools available to intelligence and law enforcement agencies to counter the terrorist threat, prevent attacks and

help ensure public security. The paper consists of 3 chapters within which I have described: in the first one, what are and what types of drones exist on the market, by which regulations they are regulated and how they are generally used in the civil, military and security fields; in the second one, the potential applications for CBRNe terrorism; in the third one the Counter UAS strategies which include detection, tracking and inactivation systems, the use of anti-terrorism drones and, finally, research and future developments of these technologies. In the conclusions I highlighted that drones today constitute a technological revolution that is useful in many sectors, both civil and military, but at the same time they can represent a threat to security as they give anyone, including criminals, the possibility of taking aerial shots or carry dangerous objects in flight while the world is not yet ready to defend itself against attacks from above. For this reason, expensive anti-drone systems have been developed and many others are being studied to try to neutralize the threat of involuntary intrusions inside sensitive areas or during events. I stressed that although RPAS offer numerous applications for law enforcement, investigators and intelligence, their use must be, with obvious exceptions, in compliance with the rules on privacy and data retention. Furthermore, this technology is considered so insidious that it has been included, through some UN resolutions, among those technologies whose uncontrolled diffusion and possession by non-state actors must be controlled and prevented. According to what emerged from my study, in the near future drones will offer more and more applications in the fields of urban security and fight against terrorism however, at the same time, the new real threat

to security will not be remotely piloted drones (RPAS) but autonomous ones which, equipped with artificial intelligence, facial recognition, perhaps able to fly in swarms and suitably programmed by malicious people, can be used as a standalone weapon to carry out targeted terrorist attacks with CBRN agents.

Chapter 1

Remotely Piloted Aircraft System (RPAS)

1.1. Overview

Remotely Piloted Aircraft Systems (RPAS), better known to the public by the generic term of drones, represent one of the most relevant innovations in recent years in the aeronautical sector. In a short time, they have had a significant and rapid development to the point of constituting a rapidly expanding market so that, according to some authoritative studies, it is expected that by 2035 the number of drones present in the Single European Sky will exceed the value of 7 million[1] and that the market of these devices will reach $ 100 billion in sectors such as transportation, security and monitoring[2].

1.1.1. *Terminology*

From a terminological point of view, different acronyms and terms have been used over time to describe unmanned

1. On this point, P. Finnegan, *UAV Production Will Total $93 Billion*, in «Teal Group News Briefs», 17 August 2015, available on www.tealgroup.com.

2. *Drones need to be encouraged and people protected*, in «The Economist», 24 January 2019, as estimate by Goldman Sachs.

aircrafts and their systems. The language used to define these systems has undergone a progressive transformation that reflects the evolution of legislation in the specific sector. The terms and abbreviations described below are those most commonly used in the civil and military fields and which are reported in the rules and regulations concerning unmanned aircrafts issued by the various Aeronautical Authorities and International Aeronautical Organizations:

- DRONE (Dynamic Remotely Operated Navigation Equipment)[3], a term that originates from the similarity between the noises emitted by the first examples of unmanned aircrafts and the hum emitted by the drone, the male bee. This term, initially used mainly in the military context to indicate an unmanned aircraft, was first used in 2015 in the technical documents of the European Aviation Safety Agency (EASA)[4]. Today the term drone is widely used to designate any type of unmanned aerial vehicle in common parlance;
- UA (Unmanned Aircraft) is «any aircraft that operates or is designed to operate autonomously or be remotely piloted, without a pilot on board»[5]. This definition includes all types of aircraft without a pilot on board, including radio-controlled flying models[6]

3. https://ptandur14.gitbook.io/everything-about-drone/ – https://www.linkedin.com/pulse/what-differences-between-drone-uav-uas-rpa-chin-thai-ong.

4. A-NPA of 31 July 2015 precisely titled *Introduction of a regulatory framework for the operation of drones*.

5. Paragraph 30 of Article 3 of Regulation (EU) 1139/2018.

6. Recital 34 of Regulation (EU) 1139/2018.

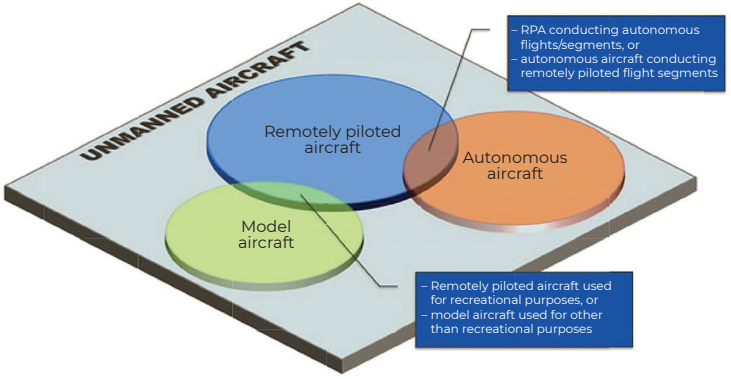

Figure 1.1. *Type of Unmanned Aircrafts (source: ICAO Doc 10019 AN/507, https://skybrary.aero/sites/default/files/bookshelf/4053.pdf).*

whether they have an on-board camera or not (figure 1.1). According to ICAO this kind of aerial vehicle, if autonomous, can be accommodated in airspace by keeping them away from other manned aircraft[7];

– UAV (Unmanned Aerial Vehicle) initially was used in the military field and subsequently was extended to the international and European civil context to indicate an aircraft capable of operating without a pilot on board[8]. This term today, considered obsolete by ICAO[9], has been replaced by Unmanned Aircraft (UA);

7. ICAO UAS Toolkit website https://www.icao.int/safety/UA/UASToolkit/Pages/FAQ.aspx#Q1.
8. Cir 328 AN/190 Unmanned Aircraft Systems (UAS) 2011.
9. APUAS/TF/1 – WP/07 03 – 05/04/2017.

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