

## Drone Use in Military and Civilian Application: Risk to National Security

Wardatul Hayat Adnan<sup>1</sup>, Mohd Fadly Khamis<sup>2</sup>  
Faculty of Communication & Media Studies,  
Universiti Teknologi MARA, Shah Alam, Malaysia<sup>1</sup>  
wardatul@uitm.edu.my<sup>1</sup>, mohdfadly@uitm.edu.my<sup>2</sup>

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### Abstract

Information travels through many different ways with the existence of the internet. Since then, the information has travelled faster than usual. Ensuring the safety of a country towards any threat through extensive analysis on the tactical communication warfare used by opponents. Therefore, the development of new technologies and tactics developed in today new modern information warfare cannot be neglected. The concept has increased tremendously since early 2019 from military use shifting to civilian application. Misuse of the drone technology will endanger the national security. Therefore, the present study aims to review the use of drones in military, and civilian application as well as to identify reasoning on its usage. It will later explain how the misuse of drone technology will affect the national security. Military drones used to collect information and act as a medium of communication in higher command control as well as terminating the opponents are found to be the modern information warfare among the users. Meanwhile, the commercial drone use among civilians fit the purpose of surveying land, buildings, entertainment, and creative industry. A Qualitative study approach used in a through secondary data (literature review) to suit the purpose of the present study. Reviews conducted using keywords search in Boolean concept. In addition, the review contents will further illustrate and explain the current use of drone among military and civilians and risk to our national security.

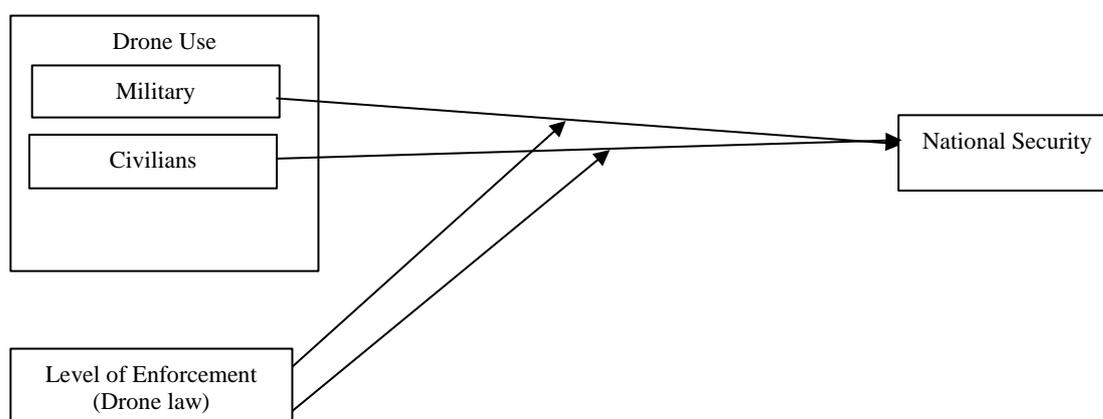
**Keywords:** Drone, UAV, military, commercial, communication, national security.

### 1.0 Introduction

Information warfare is the manipulation of information trusted by a target without the target's awareness that led the targeted make decisions against their interest. The main objective of information warfare is to achieve information superiority over an adversary. It might mean more information; it does mean better information. This condition may be obtained from the analysis or the information as well as the use of suitable medium in disseminating information to reach its targeted audience. At the same time, Information Warfare means denying information superiority to an adversary to obtain advantage in a situation. The development of new technology has made the information collection and distribution in a unique form such as drone technology. In the present study, the aims are to explore the use of drone use in both military and civilians. In tactical warfare drone was used to collect information from the opponents such as by sending a swarm of drones to the opponent's sites in collecting information. Sending drones are psychologically creating a perception of fear, threat and insecure. This is due the use of drone mostly in military and spy methods to gather information. Justifying the mentioned situation, previous studies claimed that there are six components of Information Warfare namely (1) Information operation (IO), (2) Psychological operations (PO), (3) Electronic warfare military deception (EMD), (4) Physical destruction (PD), (5) Security measures

(SM), and (6) Information attacks (IA) [1]. For instance, Information operation (IO) itself can be divided into offensive (e.g., computer network attack, command and control warfare, special information operations), civil affairs, public affairs (media warfare), and defensive IO (e.g., physical security, computer network defence, and counter propaganda) [2].

This has led further debate between scholars and experts relating drone threats in national security issues through the spy equipment through surveillance systems. Technology advancement nowadays has led towards more complexity in collecting information in one country and called Modern warfare. Modern warfare is a warfare that is notable in contrast with previous military concept, method, and technology, emphasizing how combatants must modernise to preserve their battle worthiness has now move forwards, with a tiny little equipment that has the capability in collecting visual images to report the situation to the command centre. Military usage of drones has become the primary use in today's world. Used a target decoy, for combat missions, research, and development and for supervision, drones have been part and parcel of the military forces worldwide [3]. Insider Intelligence reported on drone technology application for commercial industrial and military drones in 2021 and the future [4]. The extension of use of drone from military to public as tool in collecting information has raise concern on national security [5]. Imagining with the current context on the use of drone technology from military to civilians. Without a strict enforcement and regulations on the use of drone technology will risk one national security. Civilians has started to use the technology using the same concept of sending visual information to the controller for the purpose of surveying, creativity, entertainment and many more. Data collection gathered from the data help its user to analyse and making decision at the same time. Sending drones, was easier and safer compared to sending physical human to record visual image at risk areas. Thus, due to its capability in capturing, recording visual images, misuse of this technology will risk national security if no or lack of enforcement on law relating to the use of drone. The present study guided from below research framework (figure 1) which later drawn the objectives of the present study



**Figure 1** Research Framework

The goal of this research is to uncover factors that influence the usage of drones by military and civilians, as well as on the misuse of the technology that has put national security at risk. The implementation of drone legislation is expected to reduce the risk of a national security breach. This continues to the next section to further understand the use of drone technology in military and among the civilians. Previous studies have been reviewed to identify the recent use and misuse of drone to support the present study.

## 2.0 Literature Review

### 2.1 Drone Technology History

After reviewing the Imperial War Museum's website on the history of drones, it stated that drones had been employed in warfare since the 19th century, when the Austrians bombed Venice using pilotless hot-air balloons. This advancement in the usage of drone as a means of communication and gathering data makes it easier to comprehend and strategies against adversaries. Drone has created its own business by developing pilotless flying vehicles that are extensively used nowadays. Unmanned technology progressed throughout the interwar era, and today, in modern combat, the use of drones has increased the amount of data acquired, as well as its richness, precision, and dependability. After the use of Queen Bee, a biplane modified to be controlled by radio from the ground. This has expanded the technology to reach its potential. Anti-aircraft gunners used Queen Bee as a remote-controlled target for target practice, similarly to Nazi V1 Doodlebug. At the most basic forms of today's cruise missiles, it is still act and use as guided bombs. Furthermore, in the 1950s, the United States (US) and others discovered that they were unmanned and might be used as remotely piloted aircraft. The tiny drones, which were radio-controlled and equipped with film cameras, flew over China and North Vietnam capturing imagery intelligence without putting their pilots in danger of being caught by the communists. During the Cold War, drones were still considered a fringe technology. Drones used to be unstable, small but expensive, and pilots had to keep their analogue radio signals within range to function.

Meanwhile, drones in the United States began as espionage planes before being upgraded to assassination weapons. Throughout Washington's 15-year-long war on terror, they have been employed in at least seven nations to fulfil those tasks. They have been collecting data, feeding the military's voracious need for combat intelligence, and tracking down and executing terrorists and rebels. Under President Barack Obama, the US drone war grew dramatically, it began their lives as espionage planes before being upgraded to assassination weapons. This has led to hundreds of strikes that have been carried out by the Pentagon's Joint Special Operations Command and the highly clandestine Central Intelligence Agency in Yemen, Pakistan, and Somalia. Advocates claim that the drone programme has saved American lives and avoided the need for clumsy military operations as was in 2003 Iraq war (The Beureau of Investigative Journalism). Figure 2 shows the history of drone use in military since 1900 to 2003. This explains that the use of drone technology is not recent, but the development of the technology improves from time to time to suits demand and needs of drone use.

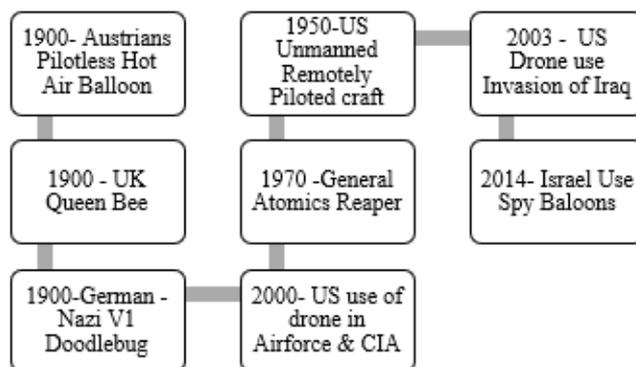


Figure 2 Drone Use in Military since 1900 to 2003

## 2.2 The use of Drone in Military and Public

The earlier limitation on limited wide beam coverage has been improvised as a result of drone use in military surveillance and as a medium to communicate via satellites. The most recent satellites feature many high-power coverage regions, each of which covers a specific geographical area. The use of GPS in drones for training purposes and to remotely control the drone to targeted regions. The primary purpose for the employment of military drones, according to the researcher, is for surveillance and intelligence gathering. Meanwhile, aircraft such as the Global Hawk and the newer Ultra LEAP, which has logged 18,000 combat flying hours, are used by military units for essential surveillance tasks. Unmanned Aerial Vehicles (UAVs), often known as drone communication, are a growing field of study that can be applied to both military and civilian applications. This has led to the conclusion that using a drone as a mode of communication to maintain links with ground stations is a good way to boost real-time data rates. In the situation of countries that still facing war, drone role is not limited as a medium of communication but also as destroyer. The ideas and concept were exploited by the Palestinians, replicating the Israeli spy balloons in figure 3[7].



Figure 3 Israeli Spy Balloons



Figure 4 Palestinian flying bomb

One of the stories [8] exposed the employment of a Skystar aerostat surveillance device in Jerusalem to track confrontations between Palestinians and Israeli military sources. Jerusalem has benefited from drone-delivered communication in protecting its national security. Drones are no longer only employed by the military; citizens are now using them as well. Figure 5 shows the positive inclination on the usage of drone among public projected by US Department of Transportation. The extension on the use of drone among public has led towards the national issues pertaining to safety. However, study conducted indicated that drone has also aided communication as key enabler of 5G and act as resilient to public safety network [9], [10], [11]. In other report found, the use of drones has also been used in assisting firefighters during emergency situations [10], [11]. The situation shows a continuous climb on the use of drone until the year 2035. Future of drone use is bright and expected to be much advanced.

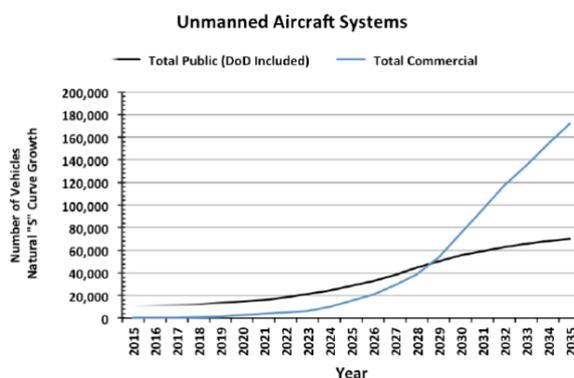


Figure 5 The Unmanned Aircraft Systems use projection.  
Source: US Department of Transportation [13]

Civilians continuously admire, the drone photography shots for the purpose of creativity and entertainment. Demand raised and, drone training course were offered to interest civilians. Normal model available for purchases DJI's latest commercial drone platform that takes inspiration from modern aviation systems. Offering up to 55 minutes of flight time, advanced AI capabilities, 6 Directional Sensing & Positioning. It also used to make a routine inspection of important infrastructure such as in oil and gas and telco infrastructure. It also assists in real time analysis of equipment health using thermal camera. Thus, the importance of drone technology was continuously solving human's problems. The importance and the use for benefiting will reward the user, misuse of one technology will lead to chaos, thus enforcement of law on the use of one technology is needed to ensure safety of one nation. The next section explains the role of drone in modern warfare that involving the civilians act as military. The act of irresponsible civilians using drone and use it for attacking is also at concern.

### 2.3 Role of drone in Modern Warfare

Modern drone Warfare also portrays in the modern gamification and gain its popularity application by modernizing it with bundling C4 with drone. This acted not limit to deliver visual communication with command centre, it acts as a destroyer in critical condition which has been captured spying or attacking by remoting drone through targeted location. The combination of C4 explosive and drones has increased its capacity as a medium of communication in the command centre as well as to diminish evidence before it is traced by the opponents. There are two types of drones used which are fixed wing drone and rotary-wing drone that both has its own advantages and its limitations. Figure 6 shows the fixed wing drone that has a simple structure with higher speed. It is contradicting with the rotary wing (figure 7) drone that allows to hover to move at any direction with vertical take-off and landing. Regardless on differences of drone types used. The similarities of both drones are meant to collect the visual data to be transmitted to the command centre for military and to the pilot for civilians remoting the drone.



**Figure 6** Drone (fixed wing)



**Figure 7** Drone (rotary wing)

The functions are extended as from communication tools in collecting visual data and now it has become as a dangerous weapon that kills. The new modern warfare is now moving forwards by using the swarm drone technique. Chan in his report, reported on UK, US, Saudi Arabia and Israeli Ministry of Defence reports on attack of drone swarms on its airspace [14]. This new revolution of drone uses as medium of communication in gathering information lead to national security threat.



**Figure 8** Illustration drone swarm  
(Source: Google image)

A generic design for job order in swarm settings is shown in the literature as seen in figure 8 [15]. UAV swarm, as noted by Mitch, Prakash, and Saleh, is an example of this architecture that may do operations that are important for commercial purposes [16]. They also mentioned that using swarm has advantages including saving time, lowering man-hours, lowering labour expenditures, and lowering other operational costs. McMullan, a researcher, believes that drone swarms will revolutionise future international battles [17].

The impact of the technological aspect on drone swarm command-and-control model strategy, as well as the human component on human difficulties in drone swarm autonomy, was underlined [18]. Drone swarms are being used in military operations to help future missions. Table 1 shows the use of drone swarms in military operations to enable further justification of the operation, including technical and human components.

**Table 1** UAV military use activities

Non-lethal	Electronic Warfare
Lethal	Close air support
	Close combat attack
	Air interdiction
	Strategic attack
	Suppression enemy air defence
	PSYOPS
	Communication relay
	SAR

## 2.4 Drone and communication

Cui, Liu, Wang and Yu explains swarm intelligence able to receive much research attention in recent years [19]. Swarms of drones' systems, as a typical application of swarm intelligence, typically demonstrate decentralised control achieved through basic agent behaviours and interactions, resulting in self-organization, which is regarded an emergence of order from the system. The system as a whole is greater than the sum of its components, capable of addressing complicated issues that no single agent could solve alone. Drone swarms and their effective deployment rely heavily on effective communication protocols. With a big swarm, a completely distributed communication system that scales effectively and maximises "many-to-many" communication is required. A drone swarm is a floating dynamic wireless network, also known as a wireless mesh network, at its most basic level.

With full or partial knowledge, reasoning can be done at the centralised control entity or on-board the UAVs. Its viable actions, on the other hand, are limited by the UAVs' capabilities and the multi-UAV system's goal. Information is disseminated by the communication and networking component. This block must be resistant to environmental changes and able to respond quickly to network topology changes. Communication is necessary not only for disseminating observations, tasks, and control information, but also for better coordinating the vehicles toward a common goal, such as monitoring a specific area or detecting events in the shortest time possible, which is especially important in disaster situations [11].

According to previous research, UAVs operate remotely by receiving commands from ground control stations [20]. These command-and-control signals are sent out via a variety of channels at varying rates [21]. Since most of the data sent to/from UAVs is sent over the air, and the majority of the data sent is very sensitive and critical [22]. In UAV communications, security is a major concern. As a result, one of the most important criteria for reliable communication between UAVs and/or between UAVs and the Ground Control Station is the security of these channels in UAV systems (GCS). UAVs' secrecy, trustworthiness, validity, and accessibility may be jeopardised as a result of security

flaws. Cryptographic procedures, in general, ensure message security and control signal assurance. Consequently, security concerns like unauthorized access, malicious control, unlawful association, or other malevolent attacks need to be mitigated effectively with limited or no consequences on the performance.

## 2.5 Drone and Law Enforcement

Law enforcement on drone differs from one country to another. The main reason is to control the use of drone and ensure the safety of one region and country at large. Brown defined in legal terms of drones, that have helped commercial use in survey due to natural disaster damages, checking on hard reach to check on any problems, bridges, towers and to showcase large estate area [23]. Meanwhile, use of drone among the militaries and police will go thorough initial flying instruction and tactical training in drone use. The training is certified by the Federal Aviation Administration (FAA), which oversees drone use in the United States.

According to FAA control drone operations but does not oversee Unmanned Aircraft System (UAS) / drone is used to gather information on people or property; that is left up to individual states or municipalities. State such as in Delaware, enforce law regulations that divide into three groups (1) To fly a drone as a commercial pilot (For instance: for work / business purposes) one is required to follow the requirements of the FAA's Part 107 Small UAS Rule (Part 107), which includes passing the FAA's Aeronautical Knowledge Test to obtain a Remote Pilot Certificate. (2) The Recreational UAS Safety Test is needed by the FAA if you want to operate a drone as a hobbyist (for fun or enjoyment). There are extra guidelines for airspace and height, as well as keeping your drone inside line-of-sight when flying. (3) To fly a drone as a government employee (i.e., for a police or fire department) one may either operate under the FAA's Part 107 rule or obtain a federal Certificate of Authorization (COA). According to Certification Requirements for Flying a Drone in the United States of America, if an individual intend to fly a drone for recreational purposes one must take The Recreational UAS Safety Test (TRUST). While, to fly a drone for commercial purposes in the U.S. you must obtain a Remote Pilot Certificate from the FAA. Below are the requirements shared obtained by UAV Coach website:-

- You must be able to read, speak, write, and understand English (exceptions may be made if the person is unable to meet one of these requirements for a medical reason, such as hearing impairment).
- You must be in a physical and mental condition to safely operate a small UAS.
- You must be at least 16 years old.
- You must pass an Aeronautical Knowledge Test (Part 107 test)
- You must undergo Transportation Safety Administration (TSA) security screening.

Source- UAV Coach, 2021 [24]

Researchers discusses the regulations in Spain regarding the use of drones, particularly among journalists [25], [26]. This has become a source of worry in Spain, since the growing usage of drones has generated serious public safety issues, as drones can collide and injure people or interfere with aeroplanes. This is also backed by a group of scholars who are concerned about the usage of drones and their impact on public safety [27]. Their use in potentially hazardous areas, such as burning buildings and flooded cities, can obstruct rescue efforts. Not to mention the possibility of unmanned aerial vehicles (UAVs) being hacked or hijacked [28]. Flying drone in Spain requires permission and it is necessary to shoot news video for media publication use. Hence, the media has no formal manual or rule. However, the popular opinion in Spain is that drone regulation is more liberal and flexible in other

countries, but not in Spain, where restrictions on drone usage for police activity filming are more stringent, even for journalists covering news.

In Malaysia, the classification of drone does not allow to be flown highlighted in different classes from A, B, C or G airspace; within an aerodrome traffic zone; or more than 400 feet above the ground. Drone pilots must maintain a direct visual line of sight with their drones during operations. Permission from the Director General must be obtained for commercial drone operations. Drones weighing more than 20 kilograms (44 pounds) may not be flown without permission from the Director General. United Kingdom also have its drone laws in flying the basic drone shared to public in order to contain security threats. Regulation such as below list regulated among its public: -

- Keep your drone in direct line of sight.
- Don't fly higher than 120m above ground.
- Avoid flying closer than 50m to people, buildings and cars.
- Don't fly closer than 150m to buildings and crowds of people.
- All drones with a camera need an Operator ID, regardless of weight.

Source: TechRadar, 2020 [29]

### 3.0 Methodology

Secondary research, often known as desk research, is a type of research that makes use of previously collected data. Existing data on the employment of drone technology in the military and among civilians is compiled and summarised. Furthermore, literature was gathered on elements that impact their decision to deploy drones, to improve the overall effectiveness of research. Secondary research was undertaken using information from journal articles, research reports, and other comparable materials, as well as credible websites.

Review on google scholar platform on "Drone and military," "drone and civilians," and "drone risk and national security" were among the keywords used in the search. Between 2018 and 2021, about 18,400 research linked to the use of drones in the military and threats 16,900 among civilians and national security were conducted. The study went on to evaluate and update the existing regulations and laws to keep tabs on how they were being used.

### 4.0 Findings

These section summaries the review findings found from the keyword search relating to drone used in military and publics (commercial use), followed by identifying factors used of drone in modern warfare as medium to communicate to the command centre base. Last but not least, it also explains on uncontrolled use of drone among the publics might threat national security.

#### **4.1 Objective 1: To identify the use of drone as a medium to communicate to military command center in monitoring air surveillance to protect national security.**

Review has illustrated and explained on the wide use of UAV or drones in military in order to protect national securities. The advancement of drone technology and strategies have expanded drone use in the swarm to further make the role of using drone in communicating in military is much efficient. The communication to the command centre using drone has becoming much easier and reliable compared to the world war I and World War II in gathering the opponent's information. Furthermore, drone use in military also not only limiting to monitoring the air surveillance but also to gather information amongst Delivery drones operating in US have risen 54% this year its competitors. The present study reviews also found that the use of explosive attached to drone, in a critical situation to whether attacking or removing evidences.

#### **4.2 Objective 2: To identify factors used on drone as a medium to communicate to air force command center in monitoring air surveillance to protect national security.**

In the study conducted by Yoo, Yu & Jung, stated that many of the users are not ready in this new technology. This perception is more towards public [30]. However, drone used has raised concerns, not only limiting to the military but also publics. The next objective of the present study focuses on the factors obtained through review. Part of the factors include operational factor that relates to the employment in military operation. Secondly on the technical factor of the strategy of command-and-control models of a drone swarm and human factor which explains on dilemmas of human in drone swarm autonomy. While study conducted by Terwilliger and his friends in 2015 added the other factor namely “perceived need” which achieving a clearer understanding of the primary factors that drive legal developments (i.e., current and future) that anticipated to improve among its stakeholders. This scholar also added that human factor now has a common expectation that humans will “learn to adapt” to the controls and displays provided with a system and, with proper training and familiarization.

#### **4.3 Objective 3: To identify purpose of drone use among civilians.**

Drones are increasingly being used by the general public for commercial objectives, such as surveying on estates, reaching difficult-to-reach visual locations for construction purposes, and even for entertainment and creative sectors. Drone law restrictions in every country will be a powerful supplement to reducing concerns about national security threats. It is fully expanded on some of the countries on drone legislation imposed to maintain national security as a first priority, as discussed in the preceding part. Drones are gaining popularity among the general public due to their ability to reduce costs, improve efficiency, and provide new innovative services. Drones are very beneficial in places that are remote, inaccessible, or dangerous. Civil drones must conform with existing civil aviation legislation, mainly the Civil Aviation Act 1982 and the Air Navigation Order 2016 (ANO) [31], according to UK statute. In 2018, the ANO was updated to include new drone restrictions, such as prohibiting small drones (up to 20 kg) from flying over 400 feet or within 1 km of airport borders, with fines [31]. Drone photography and filming for research, business or recreational purposes, environmental monitoring, emergency response to aid search and rescue, and sport are all examples of public use of drones.

#### **4.4 Objective 4: To identify the misuse of drones and threat to national security**

Drones can collect data and photographs without attracting attention, causing many people to worry that their right to privacy is being violated. If government agencies deploy drones to survey the public, this might happen. Meanwhile, if users are unfamiliar with drone technology or the legislation, they may mistakenly fly dangerously or into a forbidden location, such as an airport. Human mistake or a technological breakdown can cause pilots to lose control unexpectedly. Other aircraft, as well as people, vehicles, and infrastructure on the ground, may be endangered as a result [33]. Drones' speed, low cost, and expanding flight range and ability to carry objects make them appealing to those who may use them maliciously, irresponsibly, carelessly, or with criminal intent, such as disrupting other aircraft. By photographing individuals without their consent, you are invading their privacy [34]. Potential facilitation of cyber-attacks, such as hijacking a Bluetooth mouse with a drone carrying a radio transmitter. Physical attacks are made easier, for example, by reconnaissance of key infrastructure or by bringing bombs or other damaging items in a terrorist attack [35]. Other illegal activities, such as smuggling contraband into jails or finding vulnerable residences for burglaries, are made possible.

### **5.0 Conclusions & Discussions**

Humans have been aided by technology in reducing risk, remaining productive, imaginative, and creative. Every technology's benefits to people would be realised if it was employed responsibly. However, when one technology is mishandled, it can be disastrous. Many news releases have backed this argument, citing the misuse of drones and the harm they pose to national security. With a little imagination, such as the Russians' recent introduction of a drone that looks like a snowy owl and is untraceable [39], the misuse of technology as advanced as this might allow them to collect information on their opponents, potentially causing a conflict between two countries.

That does not, however, apply simply to Russia; it also applies to other countries. The deployment of a drone carrying a radio transmitter for instance able to hijack a Bluetooth mouse could potentially facilitate cyber-attacks. This worsens the national security in protecting one country. In compare to cyber-attacks, physical attacks are made easier by reconnaissance of key infrastructure or the transport of explosives or other damaging items in a terrorist attack [35], [36], [37]. Yet, both of the attacks will unguard our national security as a whole. Drone operations in restricted places such as airports put people in danger of an accident or data collection that is illegally obtained by the public for security purposes. Therefore, rules and regulation and its enforcement towards the drone users are crucial to ensure the national security.

## 6.0 References

- [1] Dóra, D. (2020). An Overview of the Development of the Russian Information Warfare Concept Part 1. *Hadtudományi Szemle*, 13(1), 27-35.
- [2] Yaacoub, J. P., Noura, H., Salman, O., & Chehab, A. (2020). Security analysis of drone's systems: Attacks, limitations, and recommendations. *Internet of Things*, 11, 100218.
- [3] Wolfendale, J. (2020). Technology as Terrorism: Police Control Technologies and Drone Warfare.
- [4] Insider Intelligence (2021). Delivery drones operating in US have risen 54% this year. <https://www.chargedetail.co.uk/tag/insider-intelligence/>
- [5] Karpowics, J. (2018). The Public and Commercial Impact of Drone Technology – An Interview with Derrick Ward. <https://www.commercialuavnews.com/public-safety/public-commercial-drone-technology-derrick-ward>
- [6] Beale, J. (2013). Drones: A rare glimpse at sophisticated US spy plane <https://www.bbc.com/news/world-us-canada-24729998>.
- [7] Washington.com (2020). UAV Rules & Protection. <https://wsdot.wa.gov/aviation/rules-protections/unmanned-aircraft-systems>.
- [10] He, D., Chan, S., & Guizani, M. (2017). Drone-assisted public safety networks: The security aspect. *IEEE Communications Magazine*, 55(8), 218-223.
- [11] Yanmaz, E., Quaritsch, M., Yahyanejad, S., Rinner, B., Hellwagner, H., & Bettstetter, C. (2017). Communication and coordination for drone networks. In *Ad hoc networks* (pp. 79-91). Springer, Cham.
- [12] Khan, M. N. H., & Neustaedter, C. (2019, May). An exploratory study of the use of drones for assisting firefighters during emergency situations. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems* (pp. 1-14).
- [13] The Bureau Investigative Journalism. History of Drone Warfare. Retrieved from <https://www.thebureauinvestigates.com/explainers/history-of-drone-warfare>.
- [14] Terwilliger, B., Vincenzi, D., Ison, D., Witcher, K., Thirtyacre, D., & Khalid, A. (2015). Influencing factors for use of unmanned aerial systems in support of aviation accident and emergency response. *Journal of Automation and Control Engineering*, 3(3), 246.
- [15] IWM Website. A Brief History of Drones. Retrieved from <https://www.iwm.org.uk/history/a-brief-history-of-drones>.

- [16] Mitch, C., Prakash, R. and Saleh, F. (2019). UAV swarm communication and control architectures: a review. *Journal of Unmanned Vehicle System*, 7(2).
- [17] McMullan, T. (2019). How Swarming Drones Will Change Warfare. Retrieved from: <https://www.bbc.com/news/technology-47555588>
- [18] Zieliński, T. (2021). Factors Determining a Drone Swarm Employment in Military Operations. *Safety & Defense*, 7(1), 59-71.
- [19] Cui, Q., Liu, P., Wang, J. and Yu, J. (2017). Brief analysis of drone swarm's communication, *IEEE International Conference on Unmanned Systems (ICUS)*, pp. 463-466, doi:10.1109/ICUS.2017.8278390.
- [20] Ko, Y., Kim, J., Duguma, D. G., Astillo, P. V., You, I., & Pau, G. (2021). Drone Secure Communication Protocol for Future Sensitive Applications in Military Zone. *Sensors*, 21(6), 2057.
- [21] Ismail, M.A.; Bierig, A. (2018). Identifying drone-related security risks by a laser vibrometer-based payload identification system. In *Proceedings of the Laser Radar Technology and Applications XXIII*, Orlando, FL, USA, 10 May 2018; Volume 10636, p. 1063603, International Society for Optics and Photonics.
- [22] Bunse, C.; Plotz, S. (2018). Security analysis of drone communication protocols. In *Proceedings of the International Symposium on Engineering Secure Software and Systems*, Paris, France, 26–27 June 2018; Springer: Cham, Switzerland, 2018; pp. 96–107.
- [23] Brown, J. (2017). Drones and law Enforcement. Retrieved from: <https://www.govtech.com/em/disaster/taking-to-the-air-drones-and-law-enforcement.html>.
- [24] UAV Coach, 2021. Drone Laws in the U.S.A.: UAV Coach (2021). <https://uavcoach.com/drone-laws-in-united-states-of-america>.
- [25] Gallardo-Camacho, J., & Rodríguez Breijo, V. (2020). Relationships between law enforcement authorities and drone journalists in Spain. *Media and Communication*, 8(3), 112-122.
- [26] Rodríguez Breijo, V., & Gallardo-Camacho, J. (2020). Relationships between Law Enforcement Authorities and Drone Journalists in Spain.
- [27] Kaleem, Z., Rehmani, M. H., Ahmed, E., Jamalipour, A., Rodrigues, J. J., Moustafa, H., & Guibene, W. (2018). Amateur drone surveillance: applications, architectures, enabling technologies, and public safety issues: part 1. *IEEE Communications Magazine*, 56(1), 14-15.
- [28] Alwateer, M., Loke, S. W., & Fernando, N. (2019). Enabling drone services: drone crowdsourcing and drone scripting. *IEEE access*, 7, 110035-110049.
- [29] TechRadar, 2020. UK drone laws: where can and can't you fly your drone?. <https://www.techradar.com/news/uk-drone-laws-where-can-and-cant-you-fly-your-drone>.
- [30] Yoo, W., Yu, E., & Jung, J. (2018). Drone delivery: Factors affecting the public's attitude and intention to adopt. *Telematics and Informatics*, 35(6), 1687-1700.
- [31] Haylen, A. (2019). Civilian drones. House of Commons Library.
- [32] Department for Transport (2016). Consultation on the Safe Use of drones in the UK.
- [33] Belcastro, C. M. et al. (2017). Hazards Identification and Analysis for Unmanned Aircraft System Operations. 17th AIAA Aviation Technology, Integration, and Operations Conference. American Institute of Aeronautics and Astronautics.
- [34] Meyer, S. (2018). Eye in the Sky – Drone Surveillance and Privacy. *CPO Magazine*.
- [35] Attack Tools. Drones for Penetration Testers. Bishop Fox.
- [36] Dunn, D. H. (2013). Drones: disembodied aerial warfare and the unarticulated threat. *International Affairs*, Vol 89, 1237–1246.
- [37] United Nations Security Council (2019). Greater Efforts Needed to Address the Potential Risks Posed by Terrorist Use of Unmanned Aircraft Systems.
- [38] Barrett, D. (2015). Burglars use drone helicopters to target homes. *Telegraph*.
- [39] Military and defence. <https://www.businessinsider.com/russia-disguised-drone-as-owl-for-deadly-purpose-2019-6>