ACCEPTED – 18 June 2020
Technology in Society

The '*risk*' of *disruptive* technology today
(A case study of aviation – enter the *drone*[1])

1. Introduction

In 2019 President Trump was quoted as saying "*I don't want Albert Einstein to be my pilot*."[2] This followed a spate of incidents, including two fatal crashes, involving the Boeing 737 MAX 8.[3] Both of which had a software system fitted called Maneuvering Characteristics Augmentation System (MCAS). While the MCAS[4] was intended to help prevent a stall, the unfamiliar action of the plane, due to the system, was believed to be the related cause of these accidents.

Trump had earlier sent a linked comment that expressed the opinion that "*Airplanes are becoming far too complex to fly. ….. **I see it all the time in many products**. Always seeking to go one unnecessary step further, when often old and simpler is far better……*"[5]

The evolutionary and revolutionary process go hand-in-hand, there is a symbiotic existence, whereby, the anthropological advancement of man in linked to the development of technology and vice versa.[6] Given this, the comments of Moffit (2016) namely, that society is in a *new era* – a zeitgeist age of rising populism, are arguably also of a linked concern. Foa and Mounk (2016) have reinforced the concepts of liberalism and democracy becoming increasingly disconnected from each other. These inherent negative undertones, no doubt, partly stems from what is perceived as an adverse consequence of globalization, one in which technology has played an instrumental part of opening up the world, and being at the forefront of this change. Yet, at the same time, it has also led to challenges and risks to society, where individuals (and even nations) feel vulnerable. The airplane typifies this concept in terms of making the world smaller by allowing greater access and speed of travel; and yet, history has also shown nations to be at risk – both in terms of warfare where planes have been both targeted and used against the civilian population (Fox, 2014b, 2015a). While, the Boeing 737 MAX incidents have revealed other risks associated with the utilization of new technology, sometimes

---

[1] Drones*:* described as *the most disruptive technology today* (commented further in this paper).
* This is linked to presentation made by the author: Sarah Jane Fox, entitled *Policing challenges in the Cyber and Autonomous era* (as well as *Cybercrimes: Emerging Trends…… and developing risks).* International Conference on Cyberlaw, Cybercrime and Cyber Security. 14–16th November, 2018 New Delhi, India.
And, to the UN which looked at technology – the benefits and risks entitled:
Sarah Jane Fox, "*Albert Einstein to be my pilot*" For the greater good - a question of trust! WSIS Forum, EC Medici Framework. 8-12 March 2019 – UN, Geneva.
The author has also made a presentation linked to her research, to Europol, Portugal, October 2019 – relating to drone risks at airports and to the Council of Europe, November 2019.
She also sits on an EU expert advisory board in respect to technology and the impact to policing and LEA's.
[2] Donald J Trump - @realDonald Trump 4:12 PM - Mar 12, 2019.
[3] An Ethiopian Airlines 737 Max (IATA Flight Code ET302) crashed on March 10th 2019. It was bound for Nairobi, and crashed after takeoff from Addis Ababa, killing 157 people.
On 29 October 2018, a Lion Air 737 (IATA Flight Code JT610) crashed on departure from Soekarno-Hatta International Airport, Jakarta, which was bound for Depati Amir Airport in Pangkal Pinanag. It crashed into the Java Sea 12 minutes after takeoff, killing all 189 passengers and crew.
[4] It is a flight control law implemented on the 737 MAX to improve aircraft handling characteristics and decrease pitch-up tendency at elevated angles of attack.
For further information see: https://www.boeing.com/commercial/737max/737-max-software-updates.page
[5] Donald J Trump - @realDonald Trump 4:12 PM - Mar 12, 2019
[6] Fox, S. J. (2018) *Policing - the technological revolution: Opportunities & Challenges!* **…..** *Technology in Society* https://doi.org/10.1016/j.techsoc.2018.09.006 (online). Printed in Technology in Society 56 (2019) 69-78.

insufficiently tested, in order to compete in a what should be viewed as a Darwinian business cycle. It has been expressed, that "*mature companies like Boeing face constant threats from new products, new competitors, and the search for new growth. Sometimes this motivates them to new heights of innovation and progress. Other times, it prompts them to pull everything back in the name of cost-cutting*."[7] Where the 737 MAX and MCAS fits into this equation is yet to be determined – history will no doubt decide this as part of the accident investigation process and societies related analysis, which will concern both the aspect of safety and invariably also the reasoning behind implementing technology – which arguably had not been as rigorously tested as it should have been. This ultimately resulted in the shut-down (believed temporary) of the 737 MAX aircraft production, with the latest projection being that it will not be cleared by the Federal Aviation Administration (FAA) to fly until at least the midpoint of 2020. This is interpreted as a loss to the company of as much as $1 billion a month;[8] but invariably this fails to take into account the cost of the human lives that have been lost through technology failures.

There can be little doubting that such drive for advancement is inherently therefore associated with profit and a competitive business practice, one which arguable also spills over into State involvement – be it control, or, on many occasions, apathy with regards to governance of developing technology. Putting profit before governance ultimately could be viewed as coming at a price, in terms of risks from a safety and security perspective. New and advancing technologies can lead to vulnerability and exposure. Aviation has also clearly shown itself to be vulnerable to purposeful attacks and security threats from outside and inside players and other predators. And, therefore, it could equally be argued that, there is a fine line between technology that enhances both safety and security and that which compromises it. This reasoning can be directed both toward the transport mode and the physical infrastructure and supporting systems – that, have as the purpose to, facilitate travel and aid the commercial side of operations.[9]

Despite both safety and security factors, transport, nonetheless, has been key to mankind's advancement anthropologically – travel by sea and air, in particular, has enabled 'us', as a species, to increase our knowledge and further our horizons. As the United Nations (UN) Secretary-General Ban Ki-moon acknowledged, "[*t*]*ransport is vital for everyone*."[10] This has included 'us' physically traveling and/or receiving goods and commodities from far off shores. It has more recently also included the virtual transport of information into our homes, and mobile devices via the internet and cyber space. Invariable 'we' mankind, rely on physical and virtual transport systems - daily.

Transport remains a way of uniting the world and is an invaluable and irreplaceable asset to the highly globalized society we live in. Transport is an enabler of economic, social, and cultural survival. Yet, of late, it has also led to a rise in fear from its users – it has become a target for purposeful assaults – even being used as weapon to attack citizens.[11] Coupled with this, society has become concerned as to the reliance of certain technology now being used in transport and to support its use…. *"transport* [and its users] *requires protection – alongside the critical infrastructure that supports it"* (Fox, 2016a).

---

[7] Darryl Campbell, 'The many human errors that brought down the Boeing 737 Max' 2 May 2019, [online at https://www.theverge.com/2019/5/2/18518176/boeing-737-max-crash-problems-human-error-mcas-faa - Accessed 25 August 2019].

[8] As reported by Elliot Hannon, 'Boeing's Temporary Shut Down of 737 Max Productions could have far-reaching implications to the U.S. Economy' Slate. 17 December, 2019. [Online at https://slate.com/news-and-politics/2019/12/boeing-temporary-shut-down-737-max-production-economics-politics-2020.html]

[9] For example, the airplane that facilitates the physical movement and the – airports and other terminals - normally associated with the comfort of and ease of passenger travel and transfer.

[10] Press Release, United Nations, New UN Group Seeks Solutions for Harnessing Rising Investments in Transport While Reducing Harmful Pollutants for Sustainable Future (Nov. 18, 2014).

[11] See discussions in the following publications: Fox (2014a,b, 2015a,b, 2016a, 2017b).
Reference is also made to publications Sweet, K.M. (2008). *Aviation and Airport Security. Terrorism and safety concerns.* Second Edition. Taylor & Francis Group. Price, J.C. & Forrest J.S. (2016). *Practical Aviation Security. Predicting and Preventing Future Threats*. Third Edition. Elsevier - amongst others,

Today, we are in the dawn of yet another 'new' technological age, which debatably runs alongside a new political era for society (Fox, 2018). This will see existing transport modes being refined, redeveloped and increasingly used with so-called 'new' state-of-the arts technology. And, at the same time, we will witness new transport modes being launched and more commonly used – such as autonomous (self-drive) automobiles and the drone (Unmanned Aerial Vehicles – UAV's[12]). Transport and our society are becoming ever-more reliant - on technology.

'Trust' invariably remains a key concept of change and development (including technology) – "*and may be viewed as a driver for and enabler of advancement; and yet, conversely, mistrust* [and fear] *could be seen to be an obstacle and inhibitor*" (Fox, 2018).

Measuring trust is, by its nature, subjective; we as humans, may have trust in and across a diversity of areas. This may include specific individuals, objects (in many instances, impacting on our safety and security) other living creatures (such as dogs and horses) plus other factors which cannot always be measured, agreed or even recognized. This paper, in the conclusion, touches on one phrase, linked to the latter concept, that is - "*Trust in God.*" It is acknowledged that this may be controversial by its nature; however, it is used and referred to as it provides a linkage back to the first paragraph of this paper as uttered by Donald Trump, President of the United States – recognizing this is written into the Seal of the United States as well as on US currency.

This said, the primary purpose of this paper relates to researching the aspect of 'risks' associated with advancing technology with specific focus on the newer transport mode of *drones*. It considers motivation and *policing* of *technology* (from the perspective of protecting society) and the governance structure that is or should be in place. In doing so, reflection is given to lesson learnt from civil aviation.

The research therefore considers the need to ensure policies and legislation are in place in order to keep pace with these technological advancements. However, while governance and protection are a factor, discussion is also given to societies acceptance of technology and specifically the aspect of 'trust' in an advancing world. Reference is made to various case studies as part of the concerns being raised by society in respect to technology.[13]

The paper is presented from a legal (including soft law/policy) and historical perspective – including predictive-future foresight.

2. Safety and Security – *Ah seguridad!*

It is important firstly to contextualize what is meant by safety and security. Living in today's modern society we expect to be safe and secure as much as is feasible and possible. Transport, which we rely on to exist, is no exception - transport must be safe, secure, efficient, and ultimately sustainable. While our ancestors utilized less sophisticated methods and modes, modern man demands, not only the access and ability to transport, and hence the right to travel, but, efficiency and high standards - in terms of comfort, even luxury, and, of course, ultimately protection when traveling.

[12] Unmanned aircraft or unmanned aerial vehicles (UAV), remotely piloted aircraft systems (RPAS) and unmanned aircraft systems (UAS) are all different ways of referring to what are most commonly known as drones. This publication makes specific reference to as Unmanned Aircraft Systems (UAS) (and Unmanned Aerial Vehicles - UAV's).

[13] Note this is not the primary focus of this specific paper as research is ongoing in this regard. This paper therefore serves an introduction to this.

That said, there is a fine line between defining, and, in many instances, determining, safety vs. security. In some languages there is less distinction than occurs in English (including as applied in a transport context).
Take Spanish as an example:

- *distancia de seguridad (Automobiles) - safe distance*
- *seguridad vial - road safety*
- *normas de seguridad - safety regulations*
- *agente de seguridad (in commercial air travel) – sky marshal* (arguably, for our security)
- *sistema de seguridad - security system*
- *zona de seguridad – security zone*

The term '*securitas*' derives from Latin – the same origin as the Spanish language is also derived from. In the English translation from seguridad - the word, 'security' (or more accurately, being 'secure') is associated with the absence of risk as well as having *trust* in something or someone.[14] However, it is recognized that the term may take various meanings depending on the area or field to which it refers. In this context it is determined that there are essentially key types of security, which are most noted and recognized as:
▪ Legal Security ▪ Personal Security ▪ Computer Security ▪ Labor Security ▪ Social Security;
However, this also crosses-back into the realms of public safety and, ultimately, well-being.

The Oxford online dictionary defines 'safety' as '*the condition of being protected from or unlikely to cause danger, risk, or injury*;'[15] and, provides the synonyms for 'safety' as: *welfare, well-being*, *protection* and *security*. Hence the separation of safety 'and/from' security (as different concepts) is complex and often misunderstood.

According to the psychologist Abraham Maslow and his pyramid – the 'Hierarchy of Needs,' safety (and security) of man occupies the second level, which is up one from the basic (physiological) needs for survival – air, food, water and shelter (see Figure 1). While Bronisław Malinowski, an anthropologist, writings on ethnography and social theory, also reinforced the fact that safety is one of the seven basic needs to be met by man.

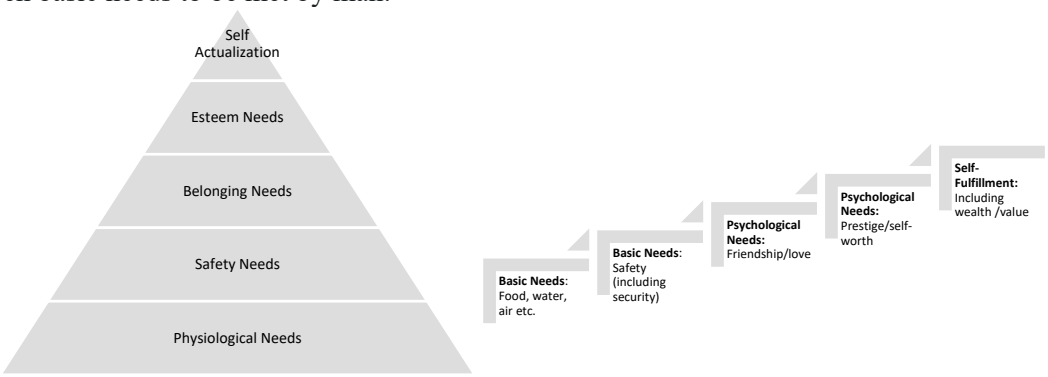

Figure 1: Maslow's Pyramid: Hierarchy of Needs

This five-stage model can be divided into deficiency needs and growth needs. The first four steps are often referred to as deficiency needs (*D-needs*), and the top level is known as 'being' or growth needs (*B-needs*). From this perspective it is arguable where the barrier crosses over into greed needs and those that compromise their fellow man.

[14] The meaning of seguridad see: https://educalingo.com/en/dic-es/seguridad
[15] Lexico: https://www.lexico.com/en/definition/safetyIt is stated that safety derives from the origins of Middle English from the Old French word sauvete, from medieval Latin salvitas, and from the Latin salvus 'safe'.

2.1. Safe travels!

Regardless of the terminology, when traveling, there consistently remains the need for "*ensuring the absence of danger that would compromise human life*" (Fox, 2017a). In essence, there is a need to confirm the consistent well-being of the traveler, *us*, in every sense and at every stage of the journey.

'We' require to be both safe and secure and we need protection to be in place to survive.

Arguably, a difference[16] between '*safety'* and *'security'* could, however, be defined and reasoned as follows:
- '*safety'* requires precautions to protect against unplanned/accidental events; Whereas,
- '*security*' necessitates protection for planned/intentional events.

In this respect, perhaps a distinction to be made also lies in terms of who is responsible for any negative action, as well as who is responsible for ultimately ensuring protection. Significantly, this calls into question where the liability lies (or should lie) regarding both safety and security incidents. And, this, in essence, has led to many a discussion ensuing as to who bares what risks and at what costs (particularly where and when terrorism has been involved[17]). The same is perhaps true with regards to the 737 MAX 8, indisputably Boeing is the central figure in terms of accountability but perhaps there are also questions to be asked in terms of the national leads, such as the U.S. Department of Transportation (DoT) which cites their mission is to "*ensure our Nation has the safest, most efficient and modern transportation system in the world,*" and particularly the Federal Aviation Administration (FAA) in terms of oversight. Taking this one step further there is perhaps an international perspective to bear in mind and the role of the United Nations body International Civil Aviation Organization (ICAO).

In the past, and certainly from a security perspective, many questions have been raised and inquiries held in order to determine the amount of knowledge any one (or more) player had in terms of an event or incident being unplanned and the crossover therefore into the realms of prevention (particularly when it is of an intentional nature). Invariably, this has consequences to determining governance systems; and, from a transport perspective, this calls into question a myriad of player's role (nationally, regionally and internationally) from the State (Government – legislator, regulator and enforcer), the manufacturer(s) the supplier(s),[18] the operator(s), the users, the insurers, etc. From this stance, it can be seen that there is an inherent cross over from the second layer into the top level (of *the pyramid of needs*) – especially when there is a profit to be made or even a potential reduction of cost to a body.[19] From this sense too, there is a potential conflict between safety/security and the implementation of methods and means to protect society (including the traveler). For the user/traveler's assessment, i.e. as to their risk exposure, this is equally dependent upon the 'trust' (and arguably knowledge as to the respective roles) they have in all the actors involved.

The aspects of safety and security are critical factors to bear in mind with the advancement and dawn of the newer transport mode - the *drone era*. Whilst they will have many roles to play – in terms of use and services they (drones) nevertheless, should be viewed as fundamentally being a transport mode. To start with (now) we may not travel in them, however, they will eventually be part of our daily existence in one form or another.

[16] In the English language at least.
[17] See discussions within Fox, S. J. (2015b) wherein reference is made to Ghobrial and Irvin, who produced a conceptual model of the effects of 9/11 on the aviation industry, which focused on airlines, airports and passengers.
[18] Of both the product (including component parts) and service.
[19] This also covers needs such as social climbing and position in authority.

Drones have actually been labeled as one of today's main disruptive technologies – in terms of changing the balance of society and displacing established practices and hence competitors.[20] It is acknowledged that drones have indeed earned this label due to the technology prompting "*a fundamental rethinking of business models, existing laws, safety and security standards, the future of transport."*[21] This, as stated, includes one of the concerns and risks of drones (and indeed other transport mode) their potential use in "*modern warfare*" including terrorist attacks.[22] This innovative, airborne, technology, stands to have a long-lasting effects for decades to come; and, only history will comment on whether it is a liberator or an oppressor to mankind.

There is no doubting that drones can be used to support and further society (Fox 2017a, 2018, 2019); yet, at the same time, there are many associated *risks* to bear in mind. Risks that need to be discussed and understood, before, as President Trump expresses – '*we go one unnecessary step further'* without 'all' necessary mechanisms being in place to protect us.

3. Risk

Most aspects of our life carry inherent/related risks. Risk has been defined in various ways. Hopkins (2014) refers to the fact that it is "a chance or possibility of danger, loss, injury or other adverse consequences," and that the definition of being "at risk" is that you are "exposed to danger."[23] While risk can be both positive and negative,[24] we tend to associate it with the later. Based upon the definition offered by Janic (2000) risk is to be viewed as the probability of an occurrence concerning a hazardous event, or events during a given timeframe.

Sage and White (1980) classified societal risk into four main types:

- Individual 'real' risk, as determined on the basis of the circumstances and as considered after their full development;
- Statistical risk, which is determined by available data relating to incidents and accidents concerning the issue being analysed;
- Predicted risk, which may be based upon relevant historical studies and analytical modelling;
- Perceived risk, which is the perception of a risk to an individual whether said to be intuitive or otherwise.

3.1. Risk(s) in travel: Case study - Aviation

Traveling, by its very nature, carries risks, many of which may compromise *our* safety, and, at times, *our* security. Civil aviation is recognized to involve all four areas of risk. Air transport is viewed as a complicated system with interlinked systems involving human operation and interaction both of a procedural and technical nature/system (Netjaov & Janic, 2008). Unlike other transport modes, aircraft accidents stand to involve added complexities due to the very nature of this form of transport. As Janic (2000) explained, this is because commercial passenger flights take place over long distances, are global in many instances, thereby involving the crossing into and over various other

[20] As referred to in Forbes, '*Drone Industry Just Beginning To Take Off'* May 15, 2018 https://www.forbes.com/sites/richardlevick/2018/05/15/drone-industry-just-beginning-to-take-off/#58a369af72bc [Accessed 8 February, 2020].
[21] Civil and military drones: Navigating a disruptive and dynamic technological ecosystem. European Parliament Briefing Document. EPRS | European Parliamentary Research Service
Author: Tania Lațici Members' Research Service PE 642.230 – October 2019
http://www.europarl.europa.eu/RegData/etudes/BRIE/2019/642230/EPRS_BRI(2019)642230_EN.pdf
[Accessed 7 February, 2020].
[22] Ibid.
[23] *See Fn. 16* (referring to the Oxford English Dictionary definition).
[24] *ISO Guide 73* states that an effect may be positive, negative, or a deviation from the expected, and that risk is often described by an event, a change in circumstances, or a consequence.

countries and continents. The associated risk of being involved in an accident when the aircraft is in flight relates to risks to passengers and crew; however, due to the very nature of flying there is also a probable risk, albeit lower, to individuals, and property on the ground (Fox, 2015b).
Loss of Control – Inflight (LOC or LOC-I) occurs when an aircraft deviates from the intended flight path or an adverse flight condition places an aircraft in a situation whereby the pilot is unable to maintain control of the aircraft.[25] LOC-is the most significant cause of fatal accidents in commercial aviation.[26] The highest risk occurs when the plane is closer to the ground – that is, when it is taking off or landing, and/or maneuvering. Forbes[27] referenced that it was during the final approach and landing stage when 48% — essentially *half* — of all fatal accidents (based on data recorded between 1959 through 2016) occurred. Whereas, taking off and starting to climb accounted for about a quarter (13%) in the same period.

However, more recently the take-off phase has been said to be the most-risky phase of flight regarding the risk of Loss of Control (LOC) recorded in flight accidents. Data on LOC-I accidents, both fatal and non-fatal, indicate that the highest number of accidents occurs during take-off.[28]
In 2018 (from a commercial perspective) there were 372 fatalities recorded;[29] a steep rise from the nine fatalities registered in 2017.[30] There were particularly three very high-profile aircraft accidents that occurred in 2018[31]:

1. The Lion Air Flight 610[32]: that crashed into the Java Sea, shortly after take-off in October, resulted in 189 deaths.
2. The Cubana de Aviación Flight 972: that crashed after take-off in May, killing 112 people on board.
3. The Saratov Airlines Flight 703: that crashed shortly after take-off in February, killing 71 passengers and flight crew.

As can be seen, the risk/ratios between take-off and final approach/landing LOC incidents can vary across years/periods. And, of late (2018/2019) the more recent Boeing 737 MAX 8 incidents have only aided to demonstrate how this fluctuation can be affected by the utilization of technology.

Determining risks involves assessment, which may mean re-visiting old and existing data, or factoring in new data and changes in parameters, i.e. due to advancements (including technology) and/or new exposures. In this sense, there is the means to be predictive when related data exists or to be projective when parallel evidence and knowledge is available. Much of this may involve modelling on known or perceived information and circumstances (Schauer et al, 2019). Bearing the acceptance or tolerance

[25] See IATA site: Loss of Control In-flight (LOC-I)
https://www.iata.org/en/programs/safety/loss-of-control-inflight/ [Accessed 15 July 20219]
[26] Ibid
[27] When Flying, Is Taking Off Really More Dangerous Than Landing? 25 October, 2017
https://www.forbes.com/sites/quora/2017/10/25/when-flying-is-taking-off-really-more-dangerous-than-landing/#232fd7c6266e [Accessed 20 August, 2019].
Also see https://www.1001crash.com/index-page-statistique-lg-2-numpage-3.html [Accessed 20 August, 2019].
[28] EASA: https://www.easa.europa.eu/easa-and-you/general-aviation/flying-safely/loss-control-take-off [Accessed, 18 July 2019]
[29] IATA: Loss of Control In-Flight Accident Analysis Report. Edition 2019
https://www.iata.org/contentassets/b6eb2adc248c484192101edd1ed36015/loc-i_2019.pdf
[30] See 'Plane crash deaths jump sharply in 2018 – but fatalities still rare' as recorded in the Guardian news at https://www.theguardian.com/world/2019/jan/02/pla Saratov Airlinesne-crash-deaths-jump-sharply-in-2018-but-fatalities-still-rare [Accessed 19 July 2019].
[31] IATA: Loss of Control In-Flight Accident Analysis Report. Edition 2019
https://www.iata.org/contentassets/b6eb2adc248c484192101edd1ed36015/loc-i_2019.pdf
[32] The aircraft was a Boeing 737 MAX 8 and was the first of the two deadly crashes involving this technology.

for a known/perceived risk depends upon the appetite of the key player and stakeholders; and, therefore factors in the potential likelihood for an event to occur.

When an '*accident*' occurs involving civil aviation it is more often, as not, investigated by an Air Accident Investigation Unit/Bureau – the purpose of which is establish cause and not to proportion blame and/or liability. The intention is to learn why the accident occurred in the first place, thereby providing essential learning and the means to taking preventative action to prevent the same (or similar) occurring in the future – this may involve where the accident/incident has been linked to safety or security.

Any incident involving the loss of life is one too many. This said, social acceptability of risk is a difficult factor to determine; while, there are variables which affect the degree of risk, which is individually tolerated. This varies depending upon many factors, such as age, experience, life exposure, geographic location, etc. Essentially, all air-travelers' accept a degree of voluntary risk, largely associated with them flying (and not being on the ground). Arguably, there is more risk being in the air that in an airport. That said, airports have also been exposed to security violations and acts intended to cause damage and loss of life, whilst particularly to workers there remains an unintended risk which could compromise their safety. However, whether the discerning passenger envisages (or even considers) the full exposure and potential, such as death of injury, is very much a case of objective and subjective personal interpretation as to the likelihood of this occurring (Janic, 2000; Netjaov & Janic, 2008).

Inevitably, the actual or perceived hazardous "risk" also stands to influence the confidence of passengers and users in utilizing the various modes at their disposal. And, no matter what the transport mode is, accidents and other incidents always reduce the public's confidence – and hence - *trust* in the safety/security of the transport system.

3.2. Risk and fears: technology

According to the World Economic Forum Global Risks Report 2019, there are increasing concerns as to the adverse consequences of technological advancements. This includes the risk of cyber-attacks and critical infrastructure failure(s). Specifically identified within this, is the linkage to transport modes, whereby technology has radically been observed to have altered risks related to the supporting infrastructure over the past decade. The critical infrastructure risks have risen as digitalization and the Internet of Things have deepened connectivity across the world. This has increased what was seen as 'the potential for malicious actors' to undertake also online attacks and amplifying the potential damage.

These findings reaffirm the results of a National Geographic survey in Britain in 2018.[33] Therein, it was found that over 21 million Brits are now more scared of flying compared to 10 years ago. There was a variety of reasons cited however engine failure and plane crashes were identified by 81% of the respondents, while trust in pilots and cabin crew was however generally high. The fear is also seen to be directly related to age – with just over a half (51%) of 25-34s identifying as being more scared for their safety compared to only just over quarter (27%) of those over 65.

A third (38%) admitted that news stories around plane crashes, disappearances and terrorist attacks had caused them to become more fearful of their security while on board an aircraft.

The rise in technology however is also seen as significant and playing an important role in adding to fears for air safety, with more than half of Brits (51%) being concerned that cyber security would be one of the biggest future threats to flying over the next 10-years – for example, stemming from flight systems being hacked. While 52% thought that drone collisions would be an issue.

[33] Viewable at: https://www.openaccessgovernment.org/brits-scared-of-flying/42966/ [Accessed 10 August, 2019].

In recent years the number of reported sighting of drones near to airports has become a major concern. In 2018-2019, airports across the globe have been forced to ground aircraft due to drone sightings. These have included Newark, New Jersey, USA, Gatwick, London, Dublin, Eire and Dubai, UEA.

A Department for Transport (UK-DfT) Commissioned survey in 2018 also confirmed that a large majority – 79% – of UK citizens also harbored concerns about drones.[34] While the competency of users was also identified as a worry by 19%, alongside equipment malfunction at 15%. The misuse of drones for crime or terror was cited at 28%.

By the very phrasing, '*cyber security*' threats are incidents identified as security breaches which compromise computer and hence personal safety. Very rarely could they be deemed to be accidental in nature, but the safety of others could also be a consequence of such actions. Inherently, any breach would also carry a risk to physical and supporting infrastructure. Positioning drone collisions and incursions, on the other hand, is potentially a little more difficult in terms of determining a purposeful act and the motive/reason for an intended action. In many ways, this is where making a distinction between safety and security is irrelevant as it should be based on the risk or likely risk of an action – for example, flying a drone whereby the action could be seen to either reckless or intentional to the safety/security of others. By the very nature, flying a drone, in the vicinity of where aircraft take-off and land presents another dimensional risk to aircraft and passengers. This is becoming an increasing concern to aviation authorities across the globe.

The USA-FAA reports that the number of such incidents has increased by around 1,200 percent worldwide over the past four years, which has led to increasing pressure being put on the air transport industry to find a way to mitigate such risks.[35] This will no doubt result in more airport closures when they are sighted due to the potential risk. And hence, flying a drone could be seen as either a threat to life, or the means to inflict economic damage, much in the same way as a computer cyber-attack could also achieve.

From a specific security perspective, it can be anticipated, that, drones will be used as a transport system/weapon to target commercial aircraft in a bid to bring them down, so action is needed now to find measures which at least reduce this probability. From a financial perspective the case-study of Gatwick Airport, London, England, just prior to Christmas 2018 – reveals the enormity of the damage caused to the economy. During a period of just over 33 hours more than 100 flights were cancelled or seriously delayed at the Airport at an estimated cost to airlines of almost $65 million. While, in February, 2019, at Dubai International Airport, the world's third-busiest gateway, where there was a closure of just 32 minutes due to a drone incursion, the cost was estimated to be $100,000 per minute (that equates to $3.2 million in total).[36]

3.2.1. Case study[37]

In February 2020, research was undertaken in the United States with a small sample group to determine (a) general concerns with advancing technology (an introduction); (b) concerns linked to

[34] Transport and Technology: Public Attitudes Tracker. Department for Transport. October 2018.
[35] Reported in aviation news:
https://www.ainonline.com/aviation-news/air-transport/2019-07-09/summit-seeks-solutions-drone-disruption
[36] Ibid. (also within a presentation made to Europol by the author, October, 2019, entitled – *Airport Challenges: Drones*).
[37] See footnote 13: re the limitations of this research in this publication (which serves only as an introduction to wider research extending outside the scope of this paper).
Noting: in this section, it is not the intention to discuss these finding at this juncture more to refer back to them during the conclusion as part of the overall findings to this research.
The researcher would like to thank DePaul University, Chicago, (Chaddick Institute and the College of Liberal Arts and Social Sciences) for facilitating this focus group/survey.
It should be noted that consent was obtained from all parties who were willing participants in this case study – which was ethically conducted.

air travel/flying and (c) thoughts relating to drones. Questions and categorizations, largely, were based upon the above two British surveys (referred to above) so as to add some comparison and contrast with the opinion(s) of those surveyed in the USA.[38]
Whilst a larger group (of 25) was approached, 20 members responded and took part in the research.[39] The breakdown of the group is shown in Chart 1.

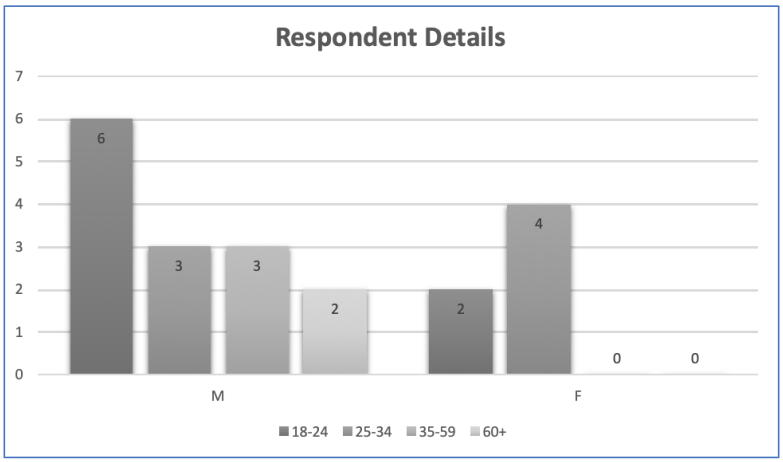

Chart 1: Breakdown of respondents by age and sex

(a) ***Asked if they had any concerns relating to new and evolving future technologies – only two respondents stated 'no.'***[40] However, it should be noted that one person worked as a specialist for a technology giant). And, the other commented that they believed law, policy and regulations caught up "*very quickly*"… "*to concerns and public threats*."

There were three main thematic topics identified as concerning the respondents. These are classified as follows:

***(a.1.) Human/humanitarian*:** with one person commenting that they were worried about a "*digital divide,*" having concerns *"relating to health and equity."* Health matters were identified by another respondent, while equity was commented upon by several respondents who referred to access (and access by marginalized communities). Another noted that they believed technology caused a distance of *"human connections."* It was also commented upon that there were concerns of technology in terms of it affecting employment with people losing jobs as a result of new and advancing developments.

One respondent also said that they believed some future technologies would benefit corporations rather than individual people.

While, an anthropological reference was also acknowledged (as previously referred to within this paper) in regards to technology advancements, that require society *"to advance as well."*

***(a.2.) Privacy*[41]:** was also referred to as a general concern relating to advancing technologies and linked to this reference was made to data mining/data exploitation.

(a.3.) Safety (security)**:** was specifically commented upon (in terms of stating 'safety' in the answer) by four respondents while only one also referred to security, alongside safety and privacy;

[38] National Geographic survey in Britain in 2018 and the Transport and Technology: Public Attitudes Tracker. Department for Transport. October 2018.
[39] All participants were asked to identify their professions, whether they worked or were a student.
[40] Both of these respondents were female in the 25-34 age bracket.
[41] It should be noted that privacy is outside the remit of this paper in the main.

another linking safety with environmental concerns; the third linking "*hacking of vital safety systems and functions*" and the fourth referred to safety more generally specifically referring to their concerns on a national and global scale. In this regard, it could be interpreted that safety and security are potentially being used interchangeably or that greater consideration is being given to safety concerns than security.

In replying, reference was made to four specific technologies that caused the respondents to be particularly concerned (Chart 2) – Artificial Intelligence (A.I.), autonomous vehicles,[42] facial recognition and robotics. However, general concerns were also expressed relating to the use of technology in warfare – citing in particular concerns over nuclear technology and biotechnologies/bioengineering.

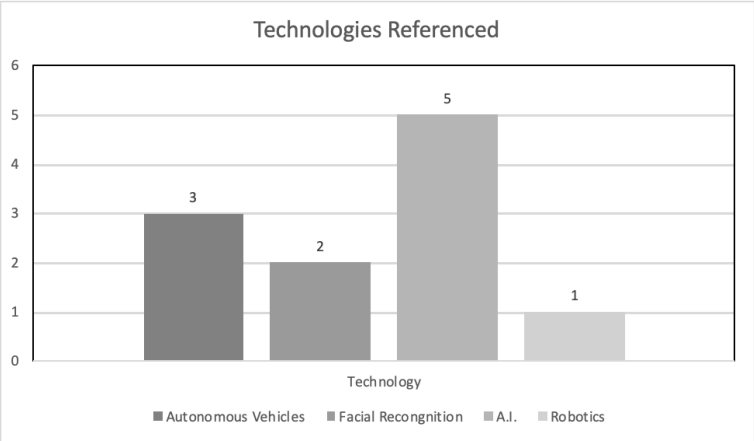

Chart 2: Technologies of concern

Respondents also identified that, whilst they had fears relating to specific technology – particularly citing Artificial Intelligence (A.I.) as well as robotics, they saw 'good and bad' application and positive potential, alongside negative use. One participant referred to the need for care and implementation in a thoughtful way so that negatives and positives could be considered and acknowledging that societal thoughts also needed to be factored in.

Therefore, the underlying message was one of caution and recognition as to the challenges of new and emerging technologies.

(b) The group were also asked specifically if they had any concerns relating to flying as a passenger / travel by air.

Out of the 20 respondents only one stated they had never flown (18-24 year old age bracket); however, they also referred to having safety concerns relating to flying although expressing the knowledge that they realized that flying was safer – saying "*I know cars are statistically more dangerous/have higher rates of deaths."*

Out of the remaining 19 respondents – 6 directly answered that they did have concerns, while the remaining 13 circled that they did not have any concerns.

(b.1.) Those expressing 'no concerns' of flying:
8 of the 13 identifying 'no concerns' did not provide any further comments.

The remaining 5 provided comments that ranged from identifying:
- The joy of flying – stating, "*its kind of fun.*"

[42] Under the heading autonomous vehicles reference was made to 'drones' and 'self-driving trucks.'

- Mitigating and being realistic as to risk of flying – "*I associate a risk with flying, as I do in cars."*
- One expressed "*unease… during the first initial lift, no real fear afterwards*."
- Another commented (as a commercially rated pilot) that while having no fears in general and while viewing "*the systems as safe overall*;" they identified that "*hacking of aircraft software poses concern."*
- The service (declining service) of airlines was also commented upon.

(b.2.) Those expressing 'concerns' of flying:
The following comments were expressed by the 6 that stated they had concerns:

- Being afraid of heights and of turbulence: this respondent was the only person to state that their fears had not intensified over the last 10-years.

While, the remaining 5 stated that their concerns had intensified over the last 10-years and were specifically due to:

- Being claustrophobic;
- Issues linked to technology: automation; lack of training; lack of understanding of automated systems;
- More congested skies (air space use);
- Labor law: leading to greater fatigue of pilots, crew and air traffic control.

Specifically cited were the following comments related to their concerns of flying, or, more particularly crashing: (by two different respondents)

- "*The rushed development of planes resulting in plane crashes*"
- And, the "*Boeing 737 Max crashes*."

(c) The 20 participates were also asked about drones (unmanned aerial vehicles) and whether they had any concerns relating to these.

Of the 5 that expressed concerns over flying (b.2.) only one stated they had concerns over drones for the following reasons:

- Quality of the systems and danger "*when flown over heavily populated areas."*
- Congestion (drone/aircraft): "*conflicts in urban areas*."

Noting: Two did not respond or said they lacked knowledge ("*didn't know*") and the other two identified they had no concerns over drones (while of these two - one of these believed they were a benefit to society in a non-military application and the other one did not believe they were of a benefit).

However, of the 13, who, stated they had, *'no concerns' of flying* (*b.1.*) – only 4 expressed they had no concerns of drones and out of the 4, one stated that they had an exception to this in terms of '*recreational designated drones*' and "*interference with commercial and private aircraft, lack of regulation about who can purchase and operate drones, privacy implications from uncontrolled drone use."*

In other words, 9 out of the 13 who had no concerns over flying had concerns over drones. Three of the nine did not believe that drones could benefit society when used in a non-military/civilian environment.

Similar to the concerns relating to new and evolving technologies (at (a) above) concerns were identified in respect to privacy, (including intrusive use over private property and their use for surveillance purposes). In this regard, 6 persons referred specifically to privacy concerns in their

responses; making the total - 7 out of 20 respondents commenting on concerns over drones linked to privacy.[43]

Of the 9, there were also concerns expressed as to safety/security and the use of drones for "*ill-intent*" and "*illegal activities*;" and, to "*perpetrate / intensify certain crimes*."

It was most notable that when referring to drones, as a specific identified technology, that the respondents made more references to safety but especially identified security as a concern (i.e. separated this as a different classification) and particularly referred to the use of drones in criminal activities than when reviewing to technology as a holistic subject (see at *a.1.* above).

4. Mitigating drone risks - lessons from aviation

One way to mitigate for risk (as well as arguably related fears/concerns) is to legislate and take measures to prevent and/or to reduce the potential for risks (including through monitoring mechanisms). However, indisputably, a proactive approach also requires realistic foresight - which includes learning from previous experiences, including mistakes.

From an international aviation perspective, there can be not denying that safety in civil aviation has been high on the agenda since the start of its commercial use. In 1944, the *Convention on International Civil Aviation*[44] (also known as *Chicago Convention*), was signed which led to a specialized agency of the United Nations, ICAO, being created. Article 44 of the Convention states the aims and objectives of ICAO, which includes, in regards to the objectives for safety, '*the safe and orderly growth of international civil aviation throughout the world,*' which '*meet the needs of the peoples of the world for safe, regular, efficient and economical air transport*,' and '*promote safety of flight in international air navigation*.' The Preamble reinforces that 'safety' and 'regularity' are the two prominent and founding corner stones of aviation.

This Convention remains in force today and hence safety continues to lie at the core of ICAO's fundamental objectives. Aviation safety therefore is subject to a complex (and arguably developing) structure both from a hierarchic and geographic (that is, at an international,[45] regional and State level) perspective.[46] With safety factors also covering a variety of aviation situations, away from the aircraft, such as aerodromes, air navigations services, airlines, etc.

While it might be argued that the drafter of the Chicago Convention could not have anticipated today's challenges and developments, it is perhaps questionable as to why more emphasis was not accorded to the issue of security – particularly when it should be noted that the discussions occurred in the midst of a world war (World War II). One in which the aircraft played a key role in causing destruction and loss of life on a mass scale. It was, after-all, the instrument used that delivered another technological advancement of the day – the atomic bomb.

Article 1, of the Convention, replicates the phrasing of the earlier 1919 Paris Convention, recognizing that each State has complete and exclusive sovereignty over the air space above its territory. The Preamble reaffirms that, "*the future development of international civil aviation can greatly help to create and preserve friendship and understanding among the nations and peoples of the world,* ***yet its abuse can become a threat to the general security****.*[47]" However, 'security' to protect international

[43] The respondent who had never flown stated that they did not have sufficient knowledge of drones to answer this question.
[44] Convention on International Civil Aviation – Doc 7300. Signed on 7 December 1944.
[45] See http://www.icao.int/safety/SafetyManagement/Pages/default.aspx for further information.
[46] This chapter merely therefore provides an overview, which is focused on international and regional strengths and weaknesses.
[47] Emphasis added.

aviation against the criminal acts of individuals, was never mentioned and factored in. In fact, it was to be some 30 years before security was annexed to the Chicago Convention as a stand-alone chapter. This followed the international multilateral Conventions earlier in the 1970s, which related to the suppression of offences, criminal prosecution and penalties. This was instigated following Assembly Resolution A17-10 and A18-10, plus further extensive studies through the ICAO Council, Air Transport Committee, Air Navigation Commission and the Unlawful Interference Committee, which subsequently led to a new set of Standards and Recommended Practices in relation to security. These were adopted on 22 March 1974 as Annex 17 – Security. Annex 17 has been amended and updated since this time and now consolidates information that was previously found in other Annexes. The basis of the Annex is to focus on preventative measures.

Ensuring preventative measures are in place necessitates being realistic and proactive; to have foresight and not to act in hindsight. From this perspective, ICAO has also addressed this lack of anticipation in respect to the security needs of aviation - stating "*with the benefit of hindsight, it may seem hard to imagine how the need to address acts of sabotage, unlawful seizure of aircraft and the use of civil aircraft in terrorist attacks (as was the case on 11 September 2001) could have been overlooked by the drafters of the Chicago Convention*."[48]

Conversely though, ICAO mitigates this by adding that, "*in 1944, however, no one foresaw such security threats and the need for security measures*." This said, since this the end of WWII, internationally, regionally and nationally there has also been a constant degree of lethargy in responding and principally being proactive to various challenges – invariably, none more so than when viewed from a security perspective. The events of 9/11 perhaps only stand to typify this. As McGoldrick (2004) discusses there has also been increased global complexity resulting from international security risks and specifically acts of terrorism, particularly in terms of international law and seeking an agreed approach. International law remains concerned with the political will of States as expressed through the acceptance of treaties or international custom by contracting nations. Abeyratne had previously (1997) identified and stressed that the only way to prevent and minimize conflict regarding substantive law and jurisdiction issues is by way of a unified system that ultimately allows for mutual rights and obligations to be ultimately clarified.

Urry (2003) rationalizes that global intricacies invariably result in a "*set of emergent systems possessing properties and patterns that are often far from equilibrium*." And that this complexity has resulted in a diverse system of "*networked time-space paths*" being established. Fox (2016a) has discussed this at lengths, in terms of the significance to aviation and provided a regional case study in respect to the influence of 9/11 to the EU Framework in terms of both safety and security.[49] In this regard it should be noted that the EU did not exist in 1944 and was undoubtedly an initiative taken forward to aid prevention of further wars, especially in Europe. The EU is not a signatory per se to the Chicago Convention but this said, it has often been perceived as a leader and influencer in respect of being more united and forward thinking in terms of advancements (Fox, 2016a).

At this juncture, it would be perhaps pertinent to state that the vulnerability to aviation directly after 9/11 resulted in the EU taking a decisive lead to establish common rules in the field of civil aviation that invariably led the world.

Without doubt, safety and security have been two key objectives behind policy changes and framework developments within the air transport sector. And, technology developments have also been key in directing and influencing such changes; however, on occasions, it could also be reasoned that there has also been a lack of foresight regarding identifying and mitigating against the risks and challenges, in some instances, of advancing technology. With the dawning of increase usage of drones

[48] ICAO website https://www.icao.int/Security/Pages/default.aspx [accessed 21 September 2019].
[49] See extensive writing by the author on discussions relating to aviation security and related developments in the listed publications.

on the horizon it is crucial to revisit lessons learnt from aviation and to review the current landscape in terms of divergence and agreed approaches directly concerning drones.

4.1. *Protecting a sector vs. one comprehensive UAV-Framework*

The Chicago Convention was not concerned with the developing areas outside of the more traditional commercial air/airplane sector.

That said, there is some brief reference to 'pilot aircrafts' within it – which states (Article 8):

> '*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.'*

As it stands today this 'may' be an aspect for consideration in relation to cross-border drone 'services' (across other nations borders).

The second part of this paragraph then states that, '*Each contracting State undertakes to insure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be controlled as to obviate danger to civil aircraft*.'[50]

The reference to 'insure' could mean the policy aspect of insurance for drones being flown – given that it is a vehicle. It would not be unrealistic to expect all drone '*users*' to have insurance in force, much in the same way it is 'necessity' for most motor vehicles, used in public places, and indeed airplanes, to have some type of insurance policy in effect at the time of operation. That said, the obligation tends to imply a State requirement, for 'ensuring' (giving assurance - rather than insuring) safe operations for all civilian aircraft that could be at risk of endangerment from unmanned aircraft.[51] In this respect, defining what an aircraft actually is not always such a straight forward process.[52] Going forward, with automation, the lines will most certainly start to blur as technology changes an accepted picture we have of specific transport modes. Professor Marsh has however countered this and has said that the Chicago Convention, through the mechanism of the International Civil Aviation Organization (ICAO)[53] clearly has provided for '…. definitions of aircraft that are the subject to its Articles, Annexes and Supplementary Agreements [and that these] include any man-made contrivance that is capable of sustained flight above the immediate surface level of the Earth…..'[54] Indeed, accordingly, therefore, an '*[a]ircraft is any machine that can derive support in the atmosphere from the reactions of the air."*[55] This said our concept of an aircraft today still envisages a pilot being at the helm of the device and a pilot that is located within the transport mode.

There are arguably similarities and differences in terms of drones and airplanes. Both have inherent linkage to modes of transport used in warfare (Fox, 2017a); yet, at the same time, both are able to bring salvation to citizens in terms of aid and humanitarian support (Fox, 2018). Currently, drones

[50] Emphasis added.
[51] As per Article 1 of the Chicago Convention – the Sovereignty element lies exclusively with each contracting State to ensure that any civil aircraft flying in a States does so with the reassurance that it remains safe from the dangers that such unmanned craft could cause.
[52] Fox, S. J. (2017) THE RISE OF THE DRONES: *Framework and Governance – Why risk it! 82 J. Air L. & Com.* 683-715.
[53] The International Civil Aviation Organization (ICAO) is a UN specialised agency, established by States to manage the administration and governance of the Convention on International Civil Aviation (Chicago Convention).
[54] Douglas Marsh, *International Regulations of Unmanned Aircraft Operations in Offshore and International Airspace*, 8 Issues Aviation L. & Pol'y, 87, 93 (2008)
[55] On November 6 1967 the International Civil Aviation Organization issued a new definition: '*Aircraft is any machine than can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth's surface.*'

are not associated with carrying passengers but undoubtedly there will be a cross over into the realms of automated – autonomous, pilotless planes that easily and frequently cross national borders and boundaries. The military deployment and utilization of drones typifies the potential direction for drones in the civilian environment – i.e. carrying payloads. In many ways – we are already seeing the early stages of their commercial use in terms of goods and services deliveries. Viewing drones as a domestic (national) issue and one which is restricted to national policies and laws remains a narrow-minded stance to take. Tests are already underway for autonomous flying taxis[56] and it is certainly within the realms of probability, if not certainty, that commercial jets will be fully autonomous which could translate to pilotless. This would then make them a UAV – the Global Air Traffic Management Operational Concept (Doc 9854) states "*an unmanned aerial vehicle is a pilotless aircraft, in the sense of Article 8 of the Convention on International Civil Aviation, which is flown without a pilot-in-command on-board and is either remotely and fully controlled from another place (ground, another aircraft, space) or programmed and fully autonomous*."[57]

However, even the definition of a UAV stands to be questioned – when reference is made to them being used as *flying-taxis* – the whole concept and understanding of various transport modes as we know them today will inevitable change with technology advancements and hence legislation, policies and framework need to recognize this and be proactive and flexible for tomorrow's movements that ensures human survival.

It is imperative that an all-encompassing framework exists that transcends sovereign controls and recognizes not only the worth of this growing industry but inevitably the challenges too. There are clearly lessons to be learnt from aviation where sovereignty, control and trust have been a constant challenge (Fox, 2014b, 2015a, 2016b).[58]

We are already seeing a replication in terms of some of the same, or very similar, issues that aviation – commercial services, have experienced with the dawning of the drone era. Only in September 2019, was it said that the USA, for example, was looking to '*protect*' its market in terms of advocating a 'buy USA campaign' (Air Transport World[59]). 'American Drone Alliance' is said to be endorsing legislation introduced 18 September 2019, in the US Senate that would prohibit federal funds from being spent to acquire commercial off-the-shelf drones manufactured by a "covered foreign entity." This would be as determined by the Secretary of Commerce; and, China is specifically said to have been identified (or arguable singled out) – since it has a dominant market in this respect. There remains a fine line as to the reasoning for some of the policies being advocated – whether these can be justified for security implications is therefore questionable. Certainly, the *new buy-American campaign*, argues that widespread use of small unmanned aerial vehicles (UAVs) made in China is suppressing the domestic industry while referring also to an inherent link (and arguable rallies to generating public fear) to Chinese military capabilities. This said, it was identified by a representative of the same group that, there was a strong feeling that, "*drone technology is both an important future industry and part of the next revolution in robotics;"* acknowledging, that, *"as it stands today, the United States* [remains] *embarrassingly behind its competition.*" For these reasons there are grounds to advocate that this latest launch to buy 'American' products and service is less linked to security concerns but more about being a closed and protected market – something which it also has a history

[56] Aviation giant 'Airbus' has successfully completed over 100 test flights in Pacific Northwest skies and in Europe, the company is flight-testing a larger robo-air taxi dubbed 'CityAirbus' – see https://www.opb.org/news/article/pacific-northwest-oregon-drone-air-taxi-airbus-test-flights/

[57] This understanding was endorsed by the 35th Session of the ICAO Assembly.

[58] Fox, amongst other has written extensively on this issue.
See also Havel, B. F. & Sanchez, G. S. (2014) The Principles and Practice of International Aviation Law. Cambridge University Press. Doganis, R. (2010) *Flying Off Course: Airline Economics and Marketing*, 4th ed., Routledge, Oxon. Milde, M. (2012) *Essential Air & Space Law*, 2nd ed., Eleven International Publishing, London, UK.

[59] As reported in Air Transport World (ATW) – *US drone makers launch buy-American campaign* September 20, 2019 https://atwonline.com/regulation/us-drone-makers-launch-buy-american-campaign [Accessed September 21, 2019].

of striving to do in term of commercial air transport-passenger operations (Fox, 2016b). This therefore has a synergy to competitive practices and a Darwinian evolutionary practice – *survival of the fittest* – where governments step in to protect national industries facing distinction and to help them sustain a market presence, thus improving the nations control and ultimately wealth.

Arguably, there has been a reluctance to take an international coordinated approach to drones – certainly in terms of an agreed framework. ICAO has been perceived to have been slow to take the lead, this said it was on 12 April 2005[60] that the Air Navigation Commission requested the Secretary General to consult 'selected' Member States and other international organizations with respect to;

> "*present and unforeseen international civil unmanned aerial vehicle (UAV) activities in civil airspace; procedures to obviate danger to civil aircraft posed by UAVs operated as State aircraft; and procedures that might be in place for the issuance of special operating authorizations for international civil UAV operations*."

In May 2006 a meeting was convened to determine the position of ICAO in respect to drones.[61] During this it was rationalized that whilst there was a role to be played by ICAO, it was not best positioned in respect to some of the specifications concerns; however, it was agreed that there was a need for harmonization of terms, strategies and principles with respect to a regulatory framework and that ICAO should be the focal point for such.

A second meeting was held in 2007[62] wherein it was concluded that work on technical specifications for UAV operations was well underway within both RTCA[63] and EUROCAE[64] with coordination provided via a joint committee of their two working groups. During which, ICAO clarified that their involvement related to the need to ensure safety and uniformity in international civil aviation operations. In this context, it was agreed that there was no specific need for new ICAO Standards and Recommended Practices (SARPs[65]) at this, deemed "early stage." It is prudent to note that no specific emphasis was accorded to security and the threat drones presented (and certainly none away from the area of airports/aerodromes).

ICAO envisages that integrating remotely-piloted UA into non-segregated airspace and at aerodromes can likely be achieved in the medium-term. This said it is also commented upon that "*complete regulatory framework for UAS will be a lengthy effort, lasting many years*." ICAO also commented upon the fact that as "technologies reach maturity", pertinent SARPs will be adopted; which, seems to contradict the reference to an "evolutionary process", whereby SARPs will be added gradually.[66]

At the present time, 2020, the current framework, is still in development but ICAO remains hopeful that the "aviation framework and that could be implemented by a broad range of States." The model currently being proposed provides a template to Member States to "*adopt or to supplement their existing UAS regulations*."[67]

It should be commented upon that the approach being taken by ICAO is, indisputably, somewhat short-sighted – the approach seems to be from a limited stance in terms of being proactive and

[60] During the 169th Session.
[61] 23-23 May, 2006 in Montreal.
[62] Palm Coast, Florida.
[63] A private, not-for-profit association, originally founded as the Radio Technical Commission for Aviation in 1935, which is involved on modern technical advancements in aviation: https://www.rtca.org
[64] European Organisation for Civil Aviation Equipment – describing their role as "the European leader in the development of worldwide recognised industry standards for aviation."
https://www.eurocae.net
[65] Safety management – SARPs are intended to assist Member States in managing aviation safety risks.
[66] Unmanned Aircraft Systems (UAS) ICAO Cir. 328 AN/190 (Year 2011). ISBN 978-92-9231-751-5.
[67] The Model UAS Regulations are titled Parts 101, 102 and 149 and are supported by Advisory Circulars (ACs) These model regulations being open for comment until 28 February 2020.

forward thinking; reference is currently only made as to the possibility of remotely piloted aircraft (RPA) becoming integrated into the provisions of Article 8 of the Chicago Convention. This therefore fails to see the potential-likelihood that UAV's and aircrafts will become morphed into one. Additionally, the framework refers openly to the fact that Member States have differing national approaches to drones, whereby some nations have legislation and others do not.

Again, the European Union have presented somewhat of a more forward thinking joined-up approach across the 27 Member States (with the position of the UK, since 31 January 2020 remaining uncertain)[68]. On 11 June 2019 the EU published common European rules on drones:

- A Commission Delegated Regulation[69] (DR) and
- A Commission Implementing Regulation[70] (IR)

This development was in keeping with The EU's 2015 aviation strategy which set an ambitious tone to explore next-generation technologies, taking leadership in innovation and embracing 'a new era of innovation and digital technologies'.[71]

The purpose stated behind both regulations was said to ensure that,

> "*Europe will be the first region in the world to have a comprehensive set of rules ensuring safe, secure and sustainable operations of drones both, for commercial and leisure activities. Common rules will help foster investment, innovation and growth in this promising sector.*"[72]
> Reference was also made to the need to *help protect, privacy of EU citizens while enabling the free circulation of drones and a level playing field within the European Union*.[73]

The DR entered into force and become applicable on 1 July 2019, while the IR, although entering into force on the same day, will not become applicable until one year later (1 July 2020). This is stated as providing time for Member States and operators to prepare and implement the requirements within, whereby operators of drones will need to register in the Member State where they have their residence or their main place of business. The UK arguably have slightly pre-empted this by their own legislation which loosely mirrors the IR and became applicable as of 30 November 2019.[74]

---

[68] The mandate for regulating civil drones became a competence of the European Commission following the new Aviation Safety Regulation. Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency, and amending Regulations (EC) No 2111/2005, (EC) No 1008/2008, (EU) No 996/2010, (EU) No 376/2014 and Directives 2014/30/EU and 2014/53/EU of the European Parliament and of the Council, and repealing Regulations (EC) No 552/2004 and (EC) No 216/2008 of the European Parliament and of the Council and Council Regulation (EEC) No 3922/91. *OJ L 212, 22.8.2018, p. 1–122*.

[69] Delegated Regulation (EU) 2019/945 of 12 March 2019 on unmanned aircraft systems and on third-country operators of unmanned aircraft systems (abbreviated to DR) C/2019/1821 *OJ L 152, 11 June 2019, p. 1–40.*

[70] Commission Implementing Regulation (EU) 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aircraft (abbreviated to IR) C/2019/3824 *OJ L 152, 11.6.2019, p. 45–71*

[71] On 7 December 2015, the Commission published a comprehensive strategy for the European aviation sector. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the regions - An Aviation Strategy for Europe. COM/2015/0598 final.

[72] Words of Patrick Ky, Executive Director of EASA (European Union Aviation Safety Agency). EASA Press release - EU wide rules on drones *Safe, secure and sustainable operation of drones.* Published 11 June, 2019

[73] Taken from the press release - EASA Press release - EU wide rules on drones *Safe, secure and sustainable operation of drones.* Published 11 June, 2019.

[74] In early 2019, the UK Government published an amendment to the UK Air Navigation Order 2016 (ANO) titled 'The Air Navigation (Amendment) Order 2019' that is detailed by the CAA in CAP 1763.
This (ANO) makes changes to the legislation regarding the operation of small unmanned aircraft (SUA's) in the UK. It is published as Statutory Instrument (SI) 2019 No. 261 entitled 'The Air Navigation (Amendment) Order 2019' and can be found at:www.legislation.gov.uk/uksi/2019/261/).
The amendment came into force on 13 March 2019 and makes changes to some aspects of the previous amendment to the ANO that was published on 30 May 2018.
See further discussions in, Fox, S. J. (2019) POLICING: MONITORING, INVESTIGATING and PROSECUTING: Drones. European Journal of Comparative Law and Governance 6 (2019) 1-57.

Unlike buying a commercial jet, the cost of a (smaller) drone is negligible - this presents an opportunity as well as a challenge, insomuch as, although regulation/framework exist or will likely exist, governance, monitoring, compliancy and enforcement will prove difficult, certainly more so than its commercial jet comparator (Fox 2017a, 2018, 2019) and even the smaller general aviation sector. Consideration of legislation and frameworks needs to extend further than a civil aviation context:

– UAV's are accessibly to a wider market; one that arguably crosses over into the realms of other comparative transport modes (such as road haulage; and, in the future, no doubt, to various other automated passenger transport systems and movements – potentially, initially based on personal usage rather than commercial utilization). Viewed from this stance, it is easier for new competitors and manufacturers to enter the market and it is easier for a wider audience to own them. At an EU level there has been some movement and reference to categories and technical requirement, even specific recognized models, however, this does not/will not prevent an owner modifying a UAV or even stop a self-build model that is not readily traceable or registered. Invariably, these factors intensify the risks in terms of both safety and security to society and these risks extend beyond the perimeters of airports and aerodromes.

While globally commercial air transport passenger demand has generally increased year on in – aviation is challenged by a number of factors, that, for cylindrical periods across a short- history, has resulted in the industry being in the red. Alexandre de Juniac, IATA's Director General and CEO, explained in 2019, that the

> "*Slowing economic growth, trade wars, geopolitical tensions and social unrest, plus continuing uncertainty over Brexit all came together to create a tougher than anticipated business environment for airlines. Yet the industry managed to achieve a decade in the black, as restructuring and cost-cutting continued to pay dividends*."[75]

These same factors are not so relevant or prevalent for drones, even when used in a commercial context. In 2019, Juniac also commented that "[t]he big question for 2020 is how capacity will develop, particularly when, as expected, the grounded 737 MAX aircraft return to service and delayed deliveries arrive."[76] What he failed to make reference to is the need to reassure the passengers flying in the (737 MAX) aircraft that they are safe. This means ensuring that there is trust – trust in the aircraft, trust in Boeing, trust in the operator, trust in the pilot, trust in the national government – and trust in all national/international regulators that have ultimately oversight for safety (and also security). This therefore extends beyond the trust of the technology to all those agencies and bodies that passengers trust to safeguard their wellbeing and reduce/mitigate risks.

Therein lies a double edge sword – for the concerns of passengers relate not only to the direct technology to be found in the aircraft but their ancillary fears too in respect to safety and security, this includes around the vicinity of the airport and aerodromes, from non-other than drones.

Summarized there are two main dates whereby changes relate to the operation of UAV's/SUA's:
(ii) those effective from 13 March 2019 (ANO 2019 amendment):

- A revised limitation on the closest distance that small unmanned aircraft of any mass may be flown from specific types of aerodrome.
- Changes to the dimensions of the 'flight restriction zones' associated with the new distance limitation from these 'protected aerodromes' and the introduction of new definitions in Schedule 1 in order to accommodate these changes.

(ii) those effective from 30 November 2019 (ANO 2018 amendment):

- A requirement for the registration of SUA operators
- A requirement for the competency of remote pilots to be tested

See CAA website re the registration requirements at https://www.caa.co.uk/Consumers/Unmanned-aircraft/Our-role/Drone-and-model-aircraft-registration/

[75] IATA Press release 69 https://www.iata.org/en/pressroom/pr/2019-12-11-01/

[76] Ibid.

On the one hand, it is recognized that technology will also continue to be an important element in aircraft safety but on the other-hand it is equally acknowledged that we can expect to see more attempts to down aircraft using drones, as well as more airport closures due to drone activities – either for the purposeful intention of threatening lives or to inflict economic damage.[77]

5. Trust: the wealth of drones vs. protecting society

As commented upon, "*drone technology is both an important future industry* [as well as] *part of the next revolution in robotics"*[78] – this equates to corporate and national wealth and this future and advancing technology, will see the capability and use of drones progressing and changing as part of the revolutionary process. The estimated wealth of drones is known to fluctuate substantially, depending upon reports read, – nevertheless, all forecasts are consistent in referring to the substantial asset of drones to the economy.

Reports have stated that the global market size for smart commercial drones was US$1 410 million in 2017 with an anticipated reach to US$179 600 million by 2025.[79] A 2017 McKinsey & Company Study estimates that by 2026, "commercial drones – both corporate and consumer applications – will have an annual impact of $31 billion to $46 billion on the [USA's] country's Gross Domestic Product."[80] However, the report also makes mention of the fact that, "[m]ost countries are now grappling with regulatory issues related to drones, as they would with any innovation that has implications for public safety." And this therein lies the crux of the problem in terms of making sure society is both safe and secure…. and reassured.

The European Commission also acknowledges, that estimates of drones to the economy will have impact of more than €10 billion per year while also directly employ more than 100,000 people in the EU by 2035.[81] However, in Europe, where more regulatory advancements have been made, it is still stated that, "*regulatory and oversight challenges remain, …. particularly regarding dual-use drones – civil drones that can be easily turned into armed drones or weaponised for criminal purposes.*"[82] This therefore intensifies the fear of the public in respect to the roll-out and use of drones.

In the same EU briefing document, it is also clearly recognized that there is still further work to be done, whereby it is said, "[a]nother challenge remaining for regulators, officials and manufacturers alike is *the need to build the trust of citizens and consumers*."

6. Conclusion

[77] Dr Chris Wyatt, The Security Impact of Drones. May 27, 2015.
https://www.openaccessgovernment.org/security-impact-drones/17769/
[78] See earlier within 4.1. *Protecting a sector vs. one comprehensive UAV-Framework.*
[79] Civil and military drones: Navigating a disruptive and dynamic technological ecosystem. European Parliament Briefing Document. EPRS | European Parliamentary Research Service.
Author: Tania Lațici Members' Research Service PE 642.230 – October 2019
[80] Commercial drones are here: The future of unmanned aerial systems. By Pamela Cohn, Alastair Green, Meredith Langstaff, and Melanie Roller. December 2017.
Viewable at: https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/commercial-drones-are-here-the-future-of-unmanned-aerial-systems [Last accessed 7 February 2020].
[81] https://ec.europa.eu/growth/sectors/aeronautics/rpas_en [Accessed 5 February, 2020].
[82] Civil and military drones: Navigating a disruptive and dynamic technological ecosystem. European Parliament Briefing Document. EPRS | European Parliamentary Research Service.
Author: Tania Lațici Members' Research Service PE 642.230 – October 2019
http://www.europarl.europa.eu/RegData/etudes/BRIE/2019/642230/EPRS_BRI(2019)642230_EN.pdf
[Accessed 7 February, 2020].

There is no doubting that technology needs to be tested to ensure that it does not compromise the wellbeing of citizens. To have faith in technology, necessitates trust – trust in the product, trust in the technology companies and trust in all players, including governments, that either endorse products or allow them to come to the marketplace. This means ensuring that users and societies are protected and are as safe and secure as is possible – by reducing risks which aids to dispel the fear of certain technologies.

This remains an essential part of gaining trust – that is, having faith that all players have societies best interests at heart and is not overly driven by profit before safety and security. Society needs to have confidence that new technology will not compromise safety and security (including the privacy of individuals) and will not be misused by government or individuals in a purposeful and malicious manner. Within this paper reference was made to the fact that, according to the World Economic Forum Global Risks Report 2019, there are increasing concerns as to the adverse consequences of technological advancements amongst the population. Surveys[83] referred to within this paper, undertaken in the United Kingdom, evidenced fears linked to advancing technology – including infiltration of critical national infrastructure, which also incorporates transportation systems. Fears associated with flying was also a feature of this research which included identifying the concerns of passengers linked to outside influences also – specifically, the technological advancement of drones. It should be noted that research undertaken in the United States demonstrated that the concerns expressed in the UK are largely replicated in the USA.[84]

Negative consequences, or possible consequences, of technology have to explored and mitigated for. Otherwise this will lead to questions, as President Trump raised, by a concerned public, as to whether new technology enhances our lives or whether, *often, old and simpler is far better?*

The USA has as its motto, "In God we trust."[85] This has symbiotic connotations to the rhetoric of Trump and with a degree of irony perhaps too – since he is a president with ultimately a high degree of control – which should equally translate to the public, which voted him into office, having trust in him for their wellbeing.

This motto was adopted by an Act of Congress, in 1782, and is used within the Seal of the United States, it has been associated arguably with wealth too - appearing on coins and paper money for a considerable period of time. However, the implication is also perhaps that only in God (or any other religious entity) can trust be found. That said, it is certainly reasonable to deduce that society will never have the same, equally sufficiently high level of trust in, not only drones, but other new and advancing technologies of tomorrow. This may be associated with the greed of industries and corporations being prominent for all to see. Certainly, today, there remains a fine line with industrial corporations and what may be perceived as emerging government corporations. It is apparent that world politics are changing as society loses faith in their elected leaders – leading to, as was commented on in the introduction - a *new era* – a zeitgeist age of rising populism (Moffit, 2016) – one in which the evolutionary process is anthropologically linked to technology advancements.

There inevitably remains conflict in terms of achieving a balance between technological innovation, the driver for development, the fear of growing and advancing technology and the means and consistency to protect society.

[83] National Geographic survey in Britain in 2018 and the Transport and Technology: Public Attitudes Tracker. Department for Transport. October 2018.
[84] Noting that the case study (at Section 3.2.1.) was not the primary focus of this paper and was limited in its nature due to only being undertaken in one location and with a small cross-section (representation) of the population.
[85] As commented at the outset it is accepted that this may be viewed as a controversial phrase – which has also been acknowledged in the USA – for example linked to the use on the currency: see some discussions within the following: https://www.thedailybeast.com/in-god-we-trust-doesnt-mean-what-you-think-it-does

This is perhaps demonstrated by returning to the technology of drones – whereby there remain fears that the competitive nature of drone growth has led to a failure to recognize and mitigate for the safety and security risks that currently exist. Only time will tell how disruptive the technology of drones will actually be.

References

Abeyratne, R. I. R. (1997). Regulatory management of the Warsaw system of air carrier liability. Journal of Air Transport Management, 3(1), 37-45.

Doganis, R. (2010) *Flying Off Course: Airline Economics and Marketing*, 4th ed., p.9, Routledge, Oxon.

Foa, R. S. & Mounk, Y (2016) The Democratic Disconnect. *Journal of Democracy Volume 27, Number 3.* pp. 5-17.

Fox, S. J. (2014a) 'Safety & Security: *The influence of 9/11 to the EU Framework.' Research in Transportation Economics* – Special Edition DOI: 10.1016/j.retrec.2014.07.004 Vol. 45 (2014), pp. 24–33

Fox, S. J. (2014b) The evolution of aviation: *In times of war and peace – blood tears and salvation! International Journal on World* Peace (2014) Vol. XXXI No. 4 Dec. pp. 49-79

Fox, S. J. (2015a) ' CONTEST'ing Chicago. Origins and Reflections: *Lest we forget!* International Journal of Private Law, (2015) Vol. 8, No. 1, pp. 73-98

Fox, S. J. (2015b) 'To practice justice and right' – international aviation liability: have lessons been learnt? International Journal of Public Law and Policy, (2015) Vol. 5, No. 2, pp. 162-182. DOI: 10.1504/1JPLAP.2015.071027

Fox, S. J. (2016a) Flying challenges for the future: Aviation preparedness – in the face of cyber-terrorism. *Journal of Transportation Security.* First published online Sept. 2016. December 2016, Volume 9, Issue 3, pp 191–218.

Fox, S. J. (2016b) Green and level playing fields: *A paradox of virtues. DUMPING – Anti-competitiveness. Int. J. Public Law and Policy, Vol. 5, No. 4, 2016,* 333-367

Fox, S. J. (2017a) THE RISE OF THE DRONES: *Framework and Governance – Why risk it! 82 J. Air L. & Com.* 683-715

Fox, S. J. (2017b) "Mobility and Movement Are 'Our' Fundamental Rights". . . Safety & Security – Risk, Choice & Conflict! *Issues in Aviation Law and Policy.* Volume 17 No. 1. Autumn, 2017, pp 7-43

Fox, S. J. (2018) *Policing - the technological revolution: Opportunities & Challenges!* **…..** *Technology in Society* *https://doi.org/10.1016/j.techsoc.2018.09.006* (online). Printed in Technology in Society 56 (2019) 69-78.

Fox, S. J. (2019) POLICING: MONITORING, INVESTIGATING and PROSECUTING: Drones. European Journal of Comparative Law and Governance 6 (2019) 1-57

Ghobrial, A. and Irvin, W. (2004) 'Combating air terrorism: some implications to the aviation

industry', *Journal of Air Transportation*, Vol. 9, No. 3, pp.68–86.

Havel, B. F. & Sanchez, G. S. (2014) *The Principles and Practice of International Aviation Law.* Cambridge University Press.

Hopkins, P (2014) Fundamentals of Risk Management. Understanding, Evaluating and Implementing Effective Risk Management. *Kogan Publishers*.

Janic, M. (2000). An assessment of risk and safety in civil aviation. *Journal of Air Transport Management,* 6(1), 43-50.

McGoldrick, D (2004). *From '9-11' to the 'Iraq War 2003' : International Law in an Age of Complexity*, Hart Publishing Limited.

Milde, M. (2012) *Essential Air & Space Law*, 2nd ed., Eleven International Publishing, London, UK.

Moffit, B. (2016) *The Global Rise of Populism*. *Performance, Political Style, and Representation*, Stanford University Press, Stanford.

Netjasov, F., & Janic, M. (2008). A review of research on risk and safety modelling in civil aviation. *Journal of Air Transport Management,* 14, 213-220.

Price, J.C. & Forrest J.S. (2016). *Practical Aviation Security. Predicting and Preventing Future Threats*. Third Edition. Elsevier

Sage, A. P., & White, E. B. (1980). Methodologies for risk and hazard assessment: a survey and status report. *IEEE Transaction on System, Man, and Cybernetics* SMC- 10, 425-441.

Schauer, S., Polemi, N. & Mouratidis, H. J. *Transp Secur* (2019) 12: 37. https://doi.org/10.1007/s12198-018-0197-x

Sweet, K.M. (2008). *Aviation and Airport Security. Terrorism and safety concerns.* Second Edition. Taylor & Francis Group.

Urry, J. (2003) *Global Complexity*. Cambridge, Polity.