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Unmanned and uncontrolled:

The commingling theory and the legality of unmanned aircraft system operations

RESEARCH THESIS

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UNMANNED AND UNCONTROLLED:

The commingling theory and the legality of unmanned aircraft system operations

Ronald I C Bartsch*

ABSTRACT

In 2002 Australia became the first nation to promulgate certification standards for the commercial use of drones or unmanned aircraft systems (UAS). Since that time the Australian Civil Aviation Safety Authority (CASA) has played a key role both domestically and internationally through the International Civil Aviation Organization (ICAO) in assisting to develop technical guidance materials that will enable contracting states to develop UAS regulations. An arduous component of this task is the fact that all existing aircraft are capable of being unmanned. Moreover, given the unbounded nature of aircraft operations, UAS regulations necessarily require international harmonisation. But the objective of developing universal UAS standards is still far from being finalised while the accelerating pace of UAS technological development continues to challenge traditional regulatory regimes and legal systems throughout the world. This paper considers the broader legal issues associated with civilian UAS operations and their integration into unsegregated civilian airspace. The Australian UAS regulatory experience is examined with some unique constitutional limitations identified in relation to the application of the so-called 'commingling theory'. It is contended that such limitations may render void existing UAS regulation in certain situations – many of which are related to the operation of small UAS and may have significant privacy implications. In particular this paper finds that the regulations purporting to control the operation of systems that are not capable of commingling with aircraft operating within navigable airspace are *ultra vires* and hence of no legal effect. In concluding this paper strongly asserts that if the commercial benefits attendant to UAS operations is to be fully realised then their risks to society must be controlled through domestic legislation that is harmonised and consistent with internationally agreed guidelines.

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1. INTRODUCTION

1.1 Background

It is no revelation that aviation and regulation are intrinsically linked. In fact it is generally recognised that aviation is the most strictly and extensively regulated industry.[1] Managing change in the context of a highly technological and rapidly changing industry has, since the advent of aircraft, been the most challenging role of governments and aviation regulators alike. However, with the rapid emergence of drones[2] in the civil aviation sector, unique issues arise that challenge existing assumptions and regulatory models. In previous instances of rapidly developing aircraft technology, notably during the two World Wars, governments were united and unanimous in their response to introduce legislation to 'harness' aviation activities. This begs the question as to whether governments throughout the world, possibly in response to a catastrophe of devastating proportions, will be similarly 'forced' into action commensurate to the risk that this new technology may present?

The introduction of unmanned aircraft systems or remotely piloted aircraft systems (RPAS) into civil aviation has been described as being as significant to this industry sector as the advent of the jet engine.[3] One international commentator goes even further and suggests that the UAS is arguably the greatest innovation in commercial aviation since the Wright brothers' Flyer.[4] Locally the Prime Minister, Mr Malcolm Turnbull, recently stated: "Australia has the potential to become a leader in these fields through a commitment to technological innovation such as remotely piloted aircraft systems".[5]

Compared with the challenges that accompany the introduction of any new technologically advanced aircraft, the integration of UAS operations into unsegregated civilian airspace present far greater challenges. For governments and regulators it is suggested that a paradigm shift may be required to effectively achieve this goal – especially considering the ambitious implementation timetable that many governments have self-imposed.[6] And it is not only the rate of development of UAS technology that requires a recalibration of approach as to how to control this area of aviation but rather the unique characteristics, capabilities and diversity of their application. As one commentator suggest UAS are evolving faster than "our ability to understand how, legally and ethically, to use them".[7]

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[1] Milde, M International Air Law and ICAO, Eleven International Publishing, Montreal, Canada, 2008.

[2] In this paper 'drone' is considered a generic term that usually relates to the military application of unmanned aerial vehicles or UAVs. A discussion of terminology, categorisation and definition is provided in section 1.3.

[3] Clothier, R 'Pilotless Aircraft: the horseless carriage of the 21st century', *Journal of Risk Research*, 2008.

[4] Marshall, Douglas M 'Dull, Dirty, and Dangerous: The FAA's Regulatory Authority Over Unmanned Aircraft Operations', *Issues Aviation Law and Policy*, 2007 p. 10105.

[5] Letter from the Hon. Malcolm Turnbull MP to the author dated 14 December 2015. The Prime Minister further stated: "I share your passion and enthusiasm for the development of unmanned aircraft whilst acknowledging the challenges that new technology can bring. I am delighted that there are industry leaders such as yourself who are willing to take risks in order to develop the Australian economy".

[6] In 2012 U.S. Congress passed the *Federal Aviation Administration and Reform Act* that ordered the Federal Aviation Administration (FAA) to promulgate regulations for the integration of UAS into the national airspace (NAS) by September 2015. As will be discussed later in this paper this ambitious task has now been curtailed so that the FAA will now have a 'plan' by September 2015, the date previously prescribed.

[7] Grossman, Lev 'Game of Drones', *Time*, 11 February 2013, at p. 28. The author goes on to describe the experience of operating this "radically new and deeply strange technology" as surreal. "A drone isn't just a tool; when you use it you see and act through it – you inhabit it. It expands the reach of your body and senses in much the same way that the Internet expands your mind. The Net extends our virtual presence; drones extend our physical presence." p. 30.

Unlike previous developments in aircraft technologies UAS are more *accessible*, *affordable*, *adaptable* and more capable of *anonymity*.[8] These 'four A' attributes of UAS are confronting governments and regulatory authorities throughout the world. It is contended that if these aircraft are to be integrated into unsegregated civil airspace, then under current laws relating to aircraft certification standards, and in accordance with international conventions, they necessarily must be subject to the same, or at least equivalent, technical and safety standards. As previously stated any aircraft flying today is capable of being flown by a remotely located pilot. Therefore if the current level of safety of our air transport system is to be maintained there must be at least an equivalent level of safety for all unmanned operations that share the same airspace.

With the rapid pace of UAS technological development and the attributes of accessible, affordable, adaptable and anonymity comes with it the potential for widespread abuse by users. The rate of UAS development and the commensurate potential for invasion of privacy, threat to national, corporate and personal security has understandably generated considerable public debate. As in the past the courts have been slow to react when addressing new technologies[9] and it has mainly been left to governments and aviation regulatory authorities to impose limits and restraints upon UAS operations or in some instances prohibit their use entirely.[10]

As one commentator describes the situation:

> Legislators, public interest groups and the public alike are resistant to the integration of this new, strange technology. They fear privacy violations, and with good reason. UAS lack the "natural limits" that constrain traditional manned aircraft. They are capable of a "swarming, persistent presence, low-level but ubiquitous and above all anonymous".[11]

1.2 Objectives and methodology

From the outset it should be pointed out that the subject matter of this research does not fit neatly within any particular academic discipline. Indeed the specific area of research essentially represents a fusion of science, society and the law. The overall objective of this paper is to examine the legal issues relating to the introduction and use of UAS technology for civilian applications. In particular it will consider the adequacy of the existing legal and regulatory frameworks that control civil aircraft operations in terms of its ability to accommodate this new technology. Because of the international context of our commercial air transport system the way in which the International Civil Aviation Organization (ICAO) is approaching the issue is of utmost importance and is closely examined. If the benefits that this new form of aircraft offer are to be fully realised, and even if integration solutions are considered first at the domestic or state level as the ICAO propose, eventually the regulatory regime for UAS operations, must be internationally harmonised. This is indeed the ICAO's objective in the strategy they had adopted in providing UAS certification guidance material to contacting states.

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[8] This expression first presented in public by Ronald Bartsch as Chair of the People & Technology Panel at the SafeSkies Australia Conference, 28 February 2013, Canberra, Australia.

[9] The analogy used recently by one Australian academic in respect to the relationship between law and technology suggests the law is "dragging its heals" and that "The dawn of the age of the drones and the potential it holds for bad as well as good provides a new challenge where the law needs to catch up in a quick and orderly fashion". Butler, Des 'The Dawn of the Age of the Drones: An Australian Privacy Law Perspective", *UNSW Law Journal*, Volume 37(2), 2014 at p. 470.

[10] For instance in the U.S. up until mid-2015 commercial UAS operations were only permitted with the grant of exemptions while other nations, for example India, currently prohibited all commercial UAS use.

[11] Hendriksen, Patrice 'Unmanned and Unchecked: Confronting The Unmanned Aircraft System Privacy Threat Through Interagency Coordination' *George Washington Law Review*, December 2013, pp. 211.

This paper, in reviewing the legal and regulatory issues associated with the introduction of UAS into civilian airspace in respect to their lawful usage, will also raise concerns of their anti-social usage and their potential use in the hands of hostile protagonists. It is beyond the function, and indeed statutory authority, of most aviation safety regulators and national air service providers (NASP) to address or even consider these issues. These matters therefore require the intervention and cooperation of governments, and their law enforcement agencies, throughout the world to effectively address the more serious, and potentially devastating, hazards associated with expanding UAS operations.

As will be highlighted later in this paper, those aspects of UAS operations that appear to be most confronting to society at present relate to the inimitable abilities and characteristics of small UAS. Until the full integration of unmanned systems into unsegregated civilian airspace occurs these types of operations will pose the greatest challenge to our current legal and regulatory systems. How governments and regulators around the world are confronting the issue vary enormously – from prohibition of commercial UAS activities with limited exemptions, as was the case in the United States until mid-2015, to the granting of over 250 UAS operating certificates for commercial applications in Australia.[12]

Of particular interest in this paper are the more fundamental aspects of the legality of UAS activities, and peculiar to Australia, the well-defined constitutional limitations in respect to the Commonwealth's power to regulate aviation activities generally. To date these limitations have been constrained since the adoption by the High Court of Australia of the so-called "commingling theory".[13] The importance of this theory to Australia in defining the limits of the Commonwealth Parliament's authority to make laws relating to aircraft – *all* aircraft including those without a pilot onboard – is explained. The central question that this paper seeks to answer can therefore be stated as: Do civilian UAS activities challenge the current constitutional limitations of the Commonwealth to regulate in respect to aviation activities? If answered in the affirmative the question then becomes: What are the specific areas of UAS operations that are beyond the Commonwealth's power to regulate them?

Unmanned aircraft are in our lives to stay, and so the task at hand is to regulate their activities but to do so there must be a legitimate source of power. This paper concludes that there are certain aspects of UAS operations that are clearly beyond the scope of the Commonwealth's purported authority to regulate them although to date these particular UAS activities are yet to be challenged in the High Court of Australia.[14]

This paper has been divided into four Parts to provide a framework to more effectively answer the questions raised above. Part 1 provides an overview of the development of civilian UAS applications and provides a contextual framework for the regulation of UAS including definitions. This part also provides an overview of the scope of legal issues that are related to the introduction of this new technology into society. Part 2 provides a detailed account of the regulatory framework for UAS, first from an international perspective and then in respect to Australia's regulatory regime.

[12] The number of commercial UAS Operating Certificates that have been granted by the Civil Aviation Safety Authority has been increasing at an almost exponential rate in the past few years: see section 2.5.
[13] Application of commingling theory to UAS operations first proposed by Ronald Bartsch, Chair, People & Technology Panel at the SafeSkies Australia Conference on 28 February 2013 in Canberra, Australia.
[14] The High Court of Australia has original jurisdiction in respect to constitutional matters.

In the third part of this paper the limitations of the scope of the Australian government's ability to regulate aviation activities generally is considered and then the particular issues that relate to the regulation of UAS activities closely examined. By way of highlighting the uniqueness of the domestic legal and regulatory issues the United States' experience is reviewed and their regulatory framework contrasted to that of the domestic regime. Finally Part 4 provides a conclusion and a final position in respect to the research questions raised in this paper.

1.3 Definitions and terminology

In terms of researching and discussing any new technology it is most important to have an accepted definition of the subject matter. However, the acceptance, use and application of such a definition are of far greater benefit to aviation generally than its possible contribution to debate or intellectual rigour. The definition for unmanned aircraft activity that is contained in this paper, and which the International Civil Aviation Organization (ICAO) has adopted is sufficiently broad to encompass the diversity of the subject matter as it exists today but also to accommodate its expansion as it increasingly impinges upon other areas of contemporary society.

Public familiarity with unmanned aircraft, popularly known as "drones," comes largely from their use in military operations abroad.[15] Unmanned aircraft or unmanned aerial vehicles (UAV) are aircraft operated without the possibility of direct human intervention from within or on the aircraft.[16] The simplicity of this definition belies, however, the complexity of classification of UAS for regulatory purposes, an issue explored in more detail in the following section.

In 2005 the International Civil Aviation Organization decided upon the use of the term "UAV" and defined it as "a pilotless aircraft – which is flown without a pilot-in-command on-board and is either remotely and fully controlled from another place . . . or programmed and fully autonomous."[17] Article 8 of the *Convention on International Civil Aviation 1944* (Chicago Convention), administered by the ICAO, provides that "no aircraft capable of being flown without a pilot [onboard] shall be flown without a pilot over the territory of a contracting State without special authorization by that State" and that "each State undertakes to insure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft".[18]

A couple of years later in 2007 the ICAO dispensed with the use of "UAV" and decided upon "UAS" as the preferred term and defined it as "an aircraft and its associated elements which are operated with no pilot on board".[19] The decision to adopt this terminology was made at the second informal ICAO meeting on unmanned aircraft[20] to align with RTCA and EUROCAE

[15] Hendriksen, Patrice 'Unmanned and unchecked: Confronting the Unmanned Aircraft System Privacy Threat Through Interagency Coordination' (2013) 82 *George Washington Law Review* 207 at p. 10.
[16] FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, § 331(8), 126 Stat. 11, 72.
[17] ICAO, *Global Air Traffic Management Operational Concept* Doc 9854 AN/458 (2005), Appendix B, p. 6.
[18] Arguably, Article 8 foresaw the integration of UAS into national airspace, see Peterson M, 'The UAV and the Current and Future Regulatory Construct for Integration into the National Airspace System' (2006) 71 *Journal of Air Law and Commerce* 521, p. 554. The historic development of the regulation of unmanned aircraft is discussed in more detail in the second Part of this paper.
[19] ICAO, 'Unmanned Aircraft Systems (UAS)' (Circular No 328-AN/190, ICAO, 2011) (x).
[20] Held at Palm Coast, Florida on 11 and 12 January 2007.

nomenclature.[21] This meeting also decided upon the establishment of the ICAO UAS Study Group (UASSG) that is described in considerable detail later in the paper.

Another two years later in 2009 the ICAO, in adopting a recommendation of the UASSG, first introduced the term "remotely piloted aircraft" or RPA. This adaptation was based on the conclusion that only unmanned aircraft that are *remotely* piloted could be integrated alongside manned aircraft into non-segregated airspace and at aerodromes. From that time on the ICAO decided to narrow its focus from *all* unmanned aircraft systems to those that are remotely piloted.

The use of the descriptor "remote" or "remotely" as an adjective allows for standard ICAO definitions to continue to be used. Therefore the definition of a pilot remains unchanged with a *remote* pilot being "a person charged by the operator with duties essential to the operation of a remotely piloted aircraft and who manipulates the flight controls, as appropriate, during flight time". Similarly a *remote* pilot-in-command is "the remote pilot designated by the operator as being in command and charged with the safe conduct of a flight". A *remote* co-pilot is a "licensed remote pilot serving in any remote piloting capacity other than as remote pilot-in-command but excluding a remote pilot serving in remote piloting capacity for the sole purpose of receiving flight instruction". And finally a *remote* flight crewmember is a "licensed remote crew member charged with duties essential to the operation of a remotely piloted aircraft system during a flight duty period".[22]

In adopting such taxonomy this provides an efficient way in which the *differences* in operating remotely piloted aircraft can be readily identified. In other words in becomes an exercise in determining the 'delta', that is, that which differs from operating UAS as compared to traditional aircraft operations with the pilot (and other crew members) onboard.

The term most commonly used in the United States and by the Federal Aviation Administration (FAA) and increasingly used by the general community and the media, is "unmanned aircraft system" or UAS.[23] The *FAA Modernization and Reform Act* of 2012 (FMRA 2012) distinguishes between the aircraft and the associated systems by defining an unmanned aircraft as "an aircraft that is operated without the possibility of direct human intervention from within or on the aircraft".[24] On the other hand "UAS" refers to the airframe as well as the associated communication links and control station and is defined as:

> An unmanned aircraft and associated elements (including communication links and the components that control the unmanned aircraft) that is required for the pilot in command to operate safely and efficiently in the national airspace system.[25]

As was stated in the Introduction to this paper, if the broader benefits that unmanned aircraft operations can provide are to be fully realised, they must be fully integrated into unsegregated airspace both domestically and internationally. Therefore, ultimately UAS terminology must

[21] The RTCA and EUROCAE had all ready decided upon the use of the term "UAS". It is also worth noting that the EASA in a policy statement: Airworthiness Certification of Unmanned Aircraft Systems (UAS) 2009 also referred to the term "UAS".
[22] Definitions extracted from the ICAO *Remotely Piloted Aircraft Systems Manual* ICAO Doc 10019. See also section 2.4.3 of this paper for further discussion of the RPASM.
[23] See U.S. Government Accountability Office, GAO-08-511, 'Unmanned Aircraft Systems: Federal Actions Needed to Ensure Safety and Expand Their Potential Uses Within the National Airspace System' 6 (2008) [hereinafter Federal Actions Needed to Ensure Safety], available at http:// www.gao.gov/assets/280/275328.pdf.
[24] FAA Modernization and Reform Act of 2012 §331(8).
[25] FAA Modernization and Reform Act of 2012 § 331(9), 126 Stat. at 72.

align throughout the world if there is to be international harmonisation. For that reason, and with the ICAO having now finalised their *Remotely Piloted Aircraft Systems Manual* (RPASM),[26] the following definitions from that manual will be used:

- *Remotely piloted aircraft (RPA)* – an unmanned aircraft which is piloted from a remote pilot station; and
- *Remotely piloted aircraft system (RPAS)* – a remotely piloted aircraft, its associated remote pilot station(s), the required command and control links and any other components as specified in the type design.

The RPASM further defines a "RPAS operator certificate" as "a certificate authorizing an operator to carry out specified RPAS operations". Although the term "UAS" is listed in the manual's glossary of acronyms the term is not defined in the RPASM. As will be discussed in the following section, because the term UAS is broader than RPAS and encompasses all types of unmanned aircraft operating systems, the previous extracted [U.S. Congress] definition of UAS will be adopted throughout this paper.

The practical reality of RPA or UAS operating in the same airspace as manned civil aircraft requires these aircraft to have ability to act and respond in real-time and comply with instrument flight rules (IFR) and visual flight rules (VFR) as per manned aircraft.[27] Depending on the situation, unmanned aircraft may be required to recognise aerodrome signs and markings, identify and avoid terrain, identify and avoid severe weather, provide visual separation from other aircraft and avoid collisions.[28] It is these technical aspects of unmanned operations, together with the legal issues associated with determining and apportioning liability, that pose the greatest challenges generally but in particular in respect of fully autonomous operating systems.

1.3.1 Fully autonomous systems

A major technical, legal and regulatory challenge of the 'pilotless' element is full automation of flight. The safety of fully autonomous flight necessarily becomes a legal question in terms of the degree of flight control that the related computers are permitted to have and where legal liability might reside. Automation of flight has been progressing at astonishing rates in the past few decades. One of the most visible effects of automation in the operation of aircraft is the progressive reduction of the number of flight crew in commercial air transport operations. In some instances the reduction has been from six flight crewmembers down to two and potentially, at least technologically, zero.[29]

Full automation will be the pinnacle of the development of unmanned flight and is strongly spurred by the technical advancement of communication and information technologies and their

[26] The ICAO RPASM was officially launched at the ICAO RPAS Symposium in Montreal, Canada commencing on 23 March 2015. See section 2.4.3.

[27] According to Marshall (Op. cit.) currently, there is no recognised technology solution that could make these aircraft capable of meeting regulatory requirements to see and avoid other aircraft, and for the command and control integrity to provide the remotely piloted aircraft with the equivalent level of safety of an aircraft with a pilot on board.

[28] See ICAO, *Unmanned Aircraft Systems Circular 328 AN/190* (2011), p 15. Article 3 of the Chicago Convention also requires civil aircraft to be able to comply with a State's request to land or deviate to a designated airport. One of the greatest challenges of full UAS integration into non-segregated airspace is technology enabling the remote pilot to identify, in real-time, the physical layout of the aerodrome so as to manoeuvre the aircraft safely.

[29] By way of example in post World War II operations Qantas [Empire] Airways typically used to operate with six technical crew members consisting of a pilot-in-command (Captain or Commander), a co-pilot (First Officer), second officer, flight navigator, flight engineer and radio operator. By way of comparison the minimum technical (flight) crew component for the world's largest commercial aircraft – the Airbus A380 – is just two pilots.

miniaturisation.[30] Remote control and fully automated operations can complement each other in a way that autonomous flight can provide redundancy if a control link fails. Even though partial or full autonomous flight operations are feasible, both the ICAO and the U.S. Congress consider that there must be human responsibility for, and with authority over, the flight of the unmanned aircraft. Accordingly, mostly based on legal argument, it must be ensured that the responsible remote pilot-in-command can override the autonomous flight mode at any time, when necessary.

In terms of ICAO terminology a RPA or RPAS cannot, by definition, include fully autonomous systems.[31] If this were the case then a consideration of RPAS in not including fully autonomous systems would impose considerable limitations of what is a rapidly developing area of UAS research and technology. For this reason, and to allow consideration of the entire scope of potential unmanned operations, fully autonomous systems will be included in this paper and therefore both terms – RPAS and UAS – will be used as applicable.

The ICAO RPASM defines an "autonomous aircraft" as "an unmanned aircraft that does not allow pilot intervention in the management of the flight". The Manual goes on to define an "autonomous operation" as "an operation during which a remotely-piloted aircraft is operating without pilot intervention in the management of the flight" – which significantly does not preclude the existence of a 'remote' pilot.

In summary the two families of terms differ to the extent that RPA/RPAS excludes fully autonomous flight, whereas UAV/UAS may include or exclude them. As the U.S. Congress requires a pilot-in-command, fully autonomous UAS are excluded from consideration of the FAA – at least at this point in time. The presence and requirement of a remote pilot has led ICAO to define this UAS-type as a remotely piloted aircraft system for the reasons described above.

Although the term 'drone' continues to be used as a generic term it is more commonly (and preferably) used to describe the military application of unmanned aircraft operations. Significantly the word 'drone' does not appear throughout the entire ICAO RPAS Manual. The ICAO, as stated in the RPAS Manual, now considers the term UAV as being "obsolete" and do not define the term in the Manual.

Elsewhere throughout the world other aviation regulators, for example the European Aviation Safety Agency (EASA) and the Australian Civil Aviation Safety Authority (CASA), in following the ICAO approach, use the terminology "remotely piloted aircraft"[32] in respect to the civilian usage of unmanned aircraft. The unmanned aircraft or RPA together with the data (command and control) link and ground control units (stations) are, as with the ICAO, collectively and respectively referred to as Unmanned Aircraft Systems (UAS) or Remotely Piloted Aircraft Systems (RPAS). For the purpose of this discussion I will (as applicable) refer to unmanned aircraft and RPA in respect to civilian applications and as a drone in military operations. The terms UAS and RPAS will refer, once again as applicable throughout this paper, to the entire system.

[30] See Cho, George 'Unmanned Aerial Vehicles: Emerging Policy and Regulatory Issues' (2012-2013) 22 *Journal of Law, Information and Science* 201.
[31] For a detailed discussion on this topic see: Clarke, Roger 'Understanding the Drone Epidemic' (2013). Article from NSW Parliamentary Website.
[32] At the time of research the CASA was considering to amend CASR Pt 101 to adopt the terminology RPA/RPAS proposed in a Notice of Proposed Rule Making (NPRM) that was finalised in late 2014.

As a concluding comment to this sub-section it is most important to understand why the adoption of internationally accepted definitions and the doctrinal framework for unmanned aircraft and remotely piloted aircraft systems must necessarily be that which has been adopted and promulgated by the ICAO. All of the 190 plus nations that are obliged to comply with the ICAO and the Standards and Recommended Practices (SARPs) contained within the 19 Annexes are therefore also obliged to comply with such standards as they relate to RPAS simply because RPAS are by definition aircraft. Moreover, any aircraft flying today has the capacity to be an unmanned aircraft. Therefore in order to effectively examine Australia's unique legal challenges in respect to RPAS operations it is necessary to consider the development of unmanned aircraft technology from an international perspective in the first instance.

1.4 Rate of development and diversity of UAS technology

Beyond definitional problems, it is now trite to say that UAS represent a game-changing development in the aviation industry. While it is estimated that only 2 per cent of current expenditure on UAS in the world encompasses civilian UAS, that percentage is expected to increase over the next decade.[33] The Association for Unmanned Vehicle Systems International (AUVSI) estimates that upon integration of UAS into civilian airspace and by 2025 more than 100,000 jobs will have been directly created in the U.S. alone and creating an economic impact of $82 billion.[34] In part, the growth predictions for UAS is a result of the potential applications of UAS to categories of work often described as 'dull, dirty, or dangerous'.[35]

Unmanned Aircraft Systems (UAS) are set to become part of everyday air traffic operations perhaps within the next few years; however, there are significant challenges that need to be addressed in order to seamlessly introduce UAS into non-segregated civil airspace. This paper discusses some of the identified safety challenges in achieving this objective in the context of the current regulatory framework. It also examines the deficiencies of the current regulatory framework especially from an Australian perspective.

Another challenging aspect of this new type of aircraft is that, since their inception, UAS have become smaller, more sophisticated, and increasingly less expensive. Their application is as varied as their design. As was described in the Introduction to this paper the rapid pace of UAS technological development can be directly related to what I describe as its "four 'A' attributes" of accessible, affordable, adaptable and anonymity.

In many counties, and in particular in the United States, the most apparent and immediate application of UAS has been in conducting surveillance. This fact is of little surprise considering this was the military application for which drones were originally developed.[36] Many UAS are fitted with high-resolution cameras and imaging technologies. The research and development arm of the UAS industry is growing exponentially.

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[33] Kapnik, Benjamin 'Unmanned But Accelerating: Navigating the Regulatory and Privacy Challenges of Introducing Unmanned Aircraft into the National Airspace System' (2012) 77 *Journal of Air Law and Commerce* 439, 441.

[34] Association for Unmanned Vehicle Systems International, *The Economic Impact of Unmanned Aircraft Systems Integration in the United States* (March 2013) <http://higherlogicdownload.s3.amazonaws.com/.

[35] Marshall, Douglas 'Dull, Dirty, and Dangerous: The FAA's Regulatory Authority Over Unmanned Aircraft Operations' (2007) 5 *Issues in Aviation Law and Policy*. See further discussion on this phrase later in this section.

[36] For example, the Global Hawk drone was initially developed for the U.S. Air Force towards the end of the 1990 and was first used shortly after the terrorist attacks over the World Trade Centre on 11 Sep. 2001. NASA's new hurricane hunters are the drones that tracked Bin Laden.

Currently, there are hundreds of types and designs of UAS of both fixed wing and rotary variants. UAS range in size from insect-like micro UAS[37] to large commercial aircraft[38] and it is this diversity of aircraft design and consequent application that is raising considerable legal issues. As one commentator suggest: "The defence and aerospace industries are propelling UAS into our lives faster than the courts and lawmakers can prepare for their ubiquitous and powerful presence".[39]

In 2012 in the United States alone, nearly fifty companies manufactured approximately 150 different UAS, resulting in a worldwide expenditure of $6 billion for UAS each year.[40] By 2020 it is estimate that some 30,000 UAS will be occupying the U.S. national airspace (NAS).[41] Further it is predicted that by 2020, U.S. $11.4 billion each year will be spent on UAS sales with a cumulative total of U.S. $89 billion over the next decade. The UAS sector is expected to create 70,000 new jobs in the first three years of integration into the NAS and over 100,000 jobs by 2025.[42]

In 2014 Australian UAS manufacturer MultiWiiCopter told the Commonwealth Parliament's House of Representatives Standing Committee[43] that its local client base included more than 5000 customers and consumer UAS vendor Parrot claimed that it has sold 500,000 UAS globally.[44] Although the market for civil use currently comprises less than 2 per cent of the worldwide market for unmanned aircraft that could change over the next several years as technology advances and as legislation and regulations allow broader use of unmanned aircraft in unsegregated civilian airspace.[45]

There is no doubt that there are significant operational and societal benefits that UAS can provide in terms of cost savings, mission diversity and potential reduction in environmental emissions in comparison to manned aircraft operations. One area in which UAS can provide significant advantages as compared with manned aircraft is in the area or reconnaissance and surveillance and this has been the major usage of unmanned aircraft in the U.S. experience. UAS have the ability to be cost effective while simultaneously raising the efficiency of law enforcement and reducing the risk to law enforcement officials.

The availability of UAS provides local law enforcement agencies with the opportunity to operate more efficiently by obtaining otherwise unavailable surveillance information that could

[37] See Natasha, Lennard "Lethal" and "unobtrusive" micro-drones are being developed by the Air force to mimic the behavior of bugs: see http://cognitiveliberty.net/2013/micro-drones-will-hide-in-plain-sight/ (Viewed 11 April 2013)

[38] For instance see Michaelides-Mateou, Sofia & Erotokritou, Chrystel 'Flying into the Future with UAVs: The Jetstream 31 Flight' 39 *Air & Space Law* 111 (2013/2014): "In April 2013, the first Remotely Piloted Aircraft System (RPAS) with two persons on board flew 500 miles in the non-segregated United Kingdom airspace at the same time as other commercial flights were being operated. On that day a new chapter in aviation history was written. This revolutionary flight reflects the rapidly expanding use of RPAS for civilian use and simultaneously raises several complex legal issues. The safe and legal operation of an aircraft is a complex task and even more so in cutting edge technological developments which thrust aviation into a new era".

[39] Farber, Hillary B 'Eyes in the Sky: Constitutional and Regulatory Approaches to Domestic Drone Deployment'. See also House of Representatives Standing Committee on Social Policy and Legal Affairs 'Eyes in the sky: Inquiry into drones and the regulation of air safety' The Parliament of the Commonwealth of Australia, Canberra, July 2014.

[40] Lowy, Joan 'Drones at Home Raise Fear of Surveillance Society' Fox NEWS (June 19, 2012), http://www.foxnews.com/us/2012/06/19/talk-drones-patrolling-us-skies-spawnsanxiety.

[41] The Future of Drones in America: Law Enforcement and Privacy Considerations, Hearing Before the S. Comm. on the Judiciary, 113th Cong. 2 (2013) (statement of Sen. Patrick J. Leahy, Chairman, S. Comm. on the Judiciary).

[42] Holstege, Sean 'Drones: Good Flies Hand in Hand with Bad', The Ariz. Republic, July 8, 2012.

[43] House of Representatives Standing Committee on Social Policy and Legal Affairs 'Eyes in the sky: Inquiry into drones and the regulation of air safety' The Parliament of the Commonwealth of Australia, Canberra, July 2014.

[44] Committee Hansard, 21 March 2014, p. 17; Committee Hansard, 28 February 2014, p. 20.

[45] Kapnik, Benjamin 'Unmanned But Accelerating: Navigating The Regulatory and Privacy Challenges of Introducing Unmanned Aircraft into The National Airspace System' (2012) 77 *Journal of Air Law and Commerce* p. 441.

potentially lead to greater and more accurate arrests.[46] UAS operations also allow for advanced national security with increased border patrol and coastal surveillance,[47] as well as the opportunity to conduct more sophisticated and effective emergency surveillance and rescue missions.[48] In a disaster, drones could be deployed quickly to assess affected areas and improve situational awareness, aiding first responders in determining the most effective allocation of resources.[49]

Of the various categories of work potentially open to UAS, other than surveillance applications, an economic study commissioned by the AUVSI suggests that precision agriculture and public safety present the most promising commercial markets, at least in the United States.[50]

What has become a popular and apt descriptor for UAS applications is that they can be used for 'dull, dirty and dangerous' missions where it would be perilous to send a human pilot for such missions.[51] In his article Marshall (2007) describes the history of unmanned or remotely piloted aircraft, the technological challenges facing operators of such systems, and the unique legal and regulatory issues that have arisen because of the rapid evolution of this new, but not-so-new, sector of aviation. In his own words Marshall describes the phrase as follows:

> "Dull, dirty and dangerous" is a common description of the potential uses and utility of unmanned aircraft, operated as military surveillance and communications platforms, hardened weapons delivery systems, observation and interdiction assets for national security and border protection, and any number of civilian or nonmilitary applications. Scientists use them for intercepting and measuring atmospheric phenomena such as hurricanes, sampling the air quality over disaster areas, and flying through volcanic eruptions where manned aircraft would risk loss of aircraft and human life, a few of the many current and envisioned aviation missions. Any current activity in which airborne assets are deployed in a "dull" (long endurance, high altitude, fatigue-inducing), "dirty" (volcanic plumes, chemical spills) or "dangerous" (high risk, low altitude such as firefighting) environment may potentially be conducted in a safer, less expensive, and more efficient manner with unmanned aircraft.[52]

As a concluding comment to this section, it appears that the potential scope of UAS application is almost limitless.[53] Even the use to date of UAS in certain applications far exceeds the capability or efficiencies of traditional manned aircraft operations. The operational costs of UAS alone are significantly lower than their manned counterparts and they can be used for extremely long periods of time.[54] One highly acclaimed UAS commentator (Michaelides-Mateou, 2014) lists a range of civilian UAS applications to include border protection in support of immigration

[46] Oyegunle, Ajoke 'Drones in the Homeland: A Potential Privacy Obstruction Under the Fourth Amendment and the Common Law Trespass Theory' (2012-2013) 21 *CommLaw Conspectus* p. 388. In Australia both the Australian Federal Police and the State police forces have utilized UAS in hostage scenarios with positive outcomes.
[47] Trials of UAS for coastal surveillance and border security in Australia have been undertaken for the past few years.
[48] The Australian Maritime Surveillance Authority (AMSA) are currently considering the use of long range, high endurance UAS for search and rescue (SAR) operations.
[49] The NSW Rural Fire Service of New South Wales has trialed UAS to provide advanced intelligence in respect to the detection and spread of bush fires.
[50] Association for Unmanned Vehicle Systems International, *The Economic Impact of Unmanned Aircraft Systems Integration in the United States* (March 2013).
[51] Term first used by Marshall, Douglas M, 'Dull, Dirty, and Dangerous: The FAA's Regulatory Authority Over Unmanned Aircraft Operations', *Issues Aviation Law and Policy*, 2007 at p. 10105.
[52] Op. cit. at p. 10085.
[53] See for example Michaelides-Mateou, Sofia & Erotokritou, Chrystel 'Flying into the Future with UAVs: The Jetstream 31 Flight' (2014) 39 Air & Space Law 111 at p133.
[54] Goldberg D, Corcoran M, and Picard R, Reuters Institute for the Study of Journalism, University of Oxford, Remotely Piloted Aircraft Systems & Journalism Opportunities and Challenges of Drones in News Gathering, June 2013, https://reutersinstitute.politics.ox.ac.uk/fileadmin/documents/Publications PDF (viewed 26 Oct. 2013)

control, law enforcement[55] and homeland security,[56] agricultural use, aerial photography, search and rescue,[57] disaster management (for e.g. the Fukushima power plant explosion in 2011)[58] and leisure activities.

1.5 The relationship between aviation, technology and the law

It is the freedom and agility by which aviation operations can readily transcend previously restrictive geographic and political boundaries that truly differentiates flying from all other modes of transport. In respect to UAS operations this 'freedom and agility' transcends to an entirely new and unprecedented level. To harness this freedom for the betterment of all, aviation regulation over all forms of aviation – whether of the manned or unmanned variety – provides the requisite authority, responsibility and sanctions. The regulation of aerial activities is as fundamental and rudimentary to the aviation industry as civil order is to modern society. In no other field of human endeavour or branch of law does there exist such a vital yet symbiotic relationship.

The above view is highlighted in the following extract:

> "The aviation industry is what it is today not in spite of, but rather because of, the law that regulates it."[59]

But with the UAS generation, as with previous eras of rapid advancement of aircraft design, performance and capability, the law is lagging science and technology. The ongoing development and use of unmanned aircraft highlights well the following recent observation:

> Law lags science; it does not lead it. UAS exemplify the modem information age, an era of computer automation, the Internet, high-definition imagery, and "smart" technology. More can be done virtually and by remote control today than at any time in history, and the corresponding actual and potential savings of personnel and resources are tangible. In aviation parlance, UAS are the leading edge of contemporary aeronautical science and engineering and a product of a century of manned flight experience. However, UAS operations have outpaced the law in that they are not sufficiently supported by a dedicated and enforceable regime of rules, regulations, and standards respecting their integration into the national airspace.[60]

Integration of UAS into contemporary society therefore presents unprecedented challenges at various levels: into modern society generally; into our legal system; into existing civil aviation regulatory framework; and into unsegregated civilian airspace.[61]

Those aspects of integration that are at present creating the greatest challenges derive from the differences between UAS and any previous type or variety of aircraft design and technology. Therefore, from a legal and regulatory perspective, the real integration difficulties stem from the

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[55] Wakefield, J BBC Global: Are drones tools of war or a social good? http://www.bbc.co.uk/news/technology (viewed 5 January 2015).

[56] Unmanned Aircraft System MQ-9 Predator B, U.S. Custom and Border Protection, 5 Jan. 2013, http://www.cbp.gov/linkhandler/cgov/border_security/am/operations/oam_vessels/aircraft/uas/predator_b.ctt/predator (viewed 27 Oct. 2013).

[57] BBC, Shaw, D 'Disaster drones: How robot teams can help in a crisis', BBC, 23 July 2012, http://www.bbc.co.uk/news/technology-18581883 (viewed 6 April 2014).

[58] See http://www.fas.org/sgp/crs/nuke/R41694.pdf (viewed 15 June 2014) re the Fukushima Nuclear Disaster, 18 January 2012.

[59] Bartsch, Ronald I C Op. cit. p. 47.

[60] Ravich, Timothy M The Integration Of Unmanned Aerial Vehicles Into The National Airspace, (2009), 85 *North Dakota Law Review* p. 597.

[61] In the United States this is defined as the National Airspace System or NAS.

inherent differences and diversities of this new form of aircraft combined with the fact, obviously, that UAS are piloted remotely and in some instances, fully autonomous. And perhaps the most sobering aspect of all is that the rate of advancement of UAS technology is showing absolutely no signs of abating and indeed is continuing to increase at an increasing rate.

As previously stated UAS or drones – as they were traditionally referred – were conceived and developed within a military milieu. UAS are, as with many previous aviation innovations – including the jet engine – a child of war. It is only a matter of time before we begin to experience their full potential within the civilian and commercial aviation sector. Unlike military UAS activities, civilian operations, particularly commercial usage, cannot rely on specially designated and restricted military airspace. Therefore, one of the key issues for operating UAS for civilian purposes will be their integration into non-segregated common airspace.

> Civilian UAVs are intended to operate in a different environment than military UAVs, namely in the common, non-segregated civilian airspace, together with all other air traffic. What is acceptable in military operations and in segregated airspace does not apply to civilian applications. At the moment, UAVs lack formal airworthiness certification by civilian aviation authorities. There are no airworthiness standards and acceptable means of compliance for those technical features of UAV technology, which go beyond traditional manned aircraft. The main obstacle for civilian UAVs to fly in non-segregated airspace is safety.[62]

As civilian usage of UAS become more and more common and their commercial and operational superiority more demonstrable, the pressure imposed upon governments and regulators for access to unsegregated and ultimately unrestricted civilian airspace will intensify. Of course there will be public outcry from certain sectors of society and individuals but cost benefit methodology will most likely prevail. Such is the nature of democratic societies. Ultimately UAS will be flying, with the same degree of freedom as manned aircraft, in non-segregated airspace. Therefore a solid legal framework on the international, regional (for example, the European Union and the EASA) and national level laying down all technical, safety and operational requirements will need to be implemented.

The diversity of application of UAS usage that differs from that of manned aircraft is what places the adequacy of existing law and regulatory framework under so much pressure. We therefore need to consider the scope of UAS activities and applications to ensure that any changes to the regulatory regime will be sufficient to accommodate and harness UAS technology now and well into the future. Australian ABC journalist Mr Mark Corcoran, who is an expert on UAS technology, stated: "I think that the problem is that the technology is now progressing at such a rate that regulators and legislators risk being buffeted in the slipstream in the slipstream".[63]

The enormity of the task of integrating UAS into unsegregated civil airspace cannot be overstated, however, the legal issues associated with UAS activities are not restricted to safety and technical regulation. While the advantages to society in general of increased usage of UAS is undeniable, because of the uniqueness of this new type of aircraft technology, its increased civilian usage also raises a number of important legal, social and ethical issues.

Most UAS activities, where regulators have permitted operations, are currently constrained to

[62] Kaiser, S 'UAVs and Their Integration into Non-segregated Airspace', 2011, p. 162.
[63] O'Sullivan, Emma 'Eyes in the Sky: New Technologies Present New Challenges for Law Makers' August (2014) *About the House* p. 46.

segregated airspace such as test sights, designated danger areas or within temporary restricted areas. On some occasions, UAS operations are permitted in an extremely limited environment outside segregated airspace. To exploit fully the unique operational capabilities of current and future UAS and thus realise the potential commercial benefits of UAS, there is a desire to be able to access all classes of airspace and operate across national borders and airspace boundaries. Such operations must achieve an acceptable level of safe but regulation should not become so inflexible or burdensome that commercial benefits are lost.

Many regulatory authorities throughout the world have adopted the above approach as they transition to a more 'safety systems' and less prescriptive approach to safety regulation. The emphasis is placed more on the operator to demonstrate to the regulator, usually through the development of an exposition, that they have established robust safety systems and procedures that ensure they can carry out their operations safely. The following extract of the Australian Civil Aviation Safety Authority clearly describes the commercial advantages of such as approach:

> Apart from the safety benefits that will be derived from this new regulatory regime clearly articulating the safety outcomes that are required, the new regulations will allow greater operational flexibility for airlines in achieving these safety outcomes. I am certain that this legislative flexibility will provide significant opportunities for your organisation in terms of integrating safety into your business planning processes.[64]

During the transition to CASA's new regulations, CASA is encouraging operations to develop safety cases to support applications, where required, for exemptions against existing regulations. This approach also applies to the restrictions imposed upon UAS operating certificates. The safety case does not need to follow any particular format but must clearly identify all risks associated with the proposed change and comprehensively articulate how they are to be managed and mitigated to an "equivalent or improved level of safety".

The above approach has been adopted by CASA in respect to UAS Operating Certificates issued under the Civil Aviation Safety Regulations (1998) Part 101. Due to the vast diversity and uniqueness of UAS operations, a highly prescriptive regulatory framework is simply not practical or feasible to encompass the scope of applications. If the legislation is structured in such a way that it prescribes the desired safety outcomes, the operator has the flexibility to structure their procedures so that they are both safe and commercially sustainable.

The viability of the commercial market for UAS, especially in the civil market, is heavily dependent on unfettered access to the same airspace as manned civilian operations to enable sustainable commercial operations. Whilst it is essential that UAS demonstrate an equivalent level of safety compared to manned operations, the current regulatory framework has evolved around the concept of an onboard pilot or pilots. There is a need to develop UAS solutions that assure an equivalent level of safety for UAS operations, which in turn will require adaptation or transition of the current regulatory framework to allow for the concept of the remote pilot without compromising the safety of other airspace users.

One of the major issues facing UAS operations is the demonstration of equivalence (in particular for detect and avoid systems) in the context of an evolving air traffic management (ATM) environment. It is very important to understand that the current ATM environment is not static. Achieving equivalence with manned operations is not a fixed target as there are many significant

[64] From a letter drafted by the writer to the CEOs of all major airlines from CASA's head of Air Transport Operations Group (ATOG) in June 2007, p. 2.

changes proposed that aim to improve operational efficiency and performance or enhance safety. On the whole proposed changes to the ATM environment could be seen as advantageous to UAS operations as more and more functions within the environment are automated[65] thus there is a significant opportunity for the UAS industry to influence the shape of the future ATM environment to support wider UAS operations.

In summary the technical standards that UAS will need to meet to be integrated into non-segregated airspace has been widely discussed[66] and it is expected that new technology will resolve many of the issues associated with UAS, including maintaining separation, establishing airworthiness, maintaining contract with air traffic control, loss of link or sight of UAS procedures, and ensuring the security of the link and base station. As these technical challenges are overcome, authorities will need to be aware of the implications for other stakeholders with aviation responsibilities.[67] For example, it has been suggested that air traffic controllers are best placed to provide separation advice for UAS operators,[68] which arguably effects a de facto transfer of responsibility for separation from the pilot of the UAS to air traffic control.

Authorities will also need to ensure that new technologies have demonstrated efficacy, but also that evidentiary requirements are met. For example, the UAS command and control link must be secure and able to detect and monitor when deliberate interference has been attempted. Equally, larger UAS may require on-board tamper proof instruments to record the actions of the pilot. In imposing these additional requirements, Authorities will have to balance the need for safety against the cost according to their individual charters.[69]

1.6 Invasion of privacy and other legal issues

1.6.1 Introduction

Protection of an individual's privacy is the most contentious issue related to non-segregated UAS operations throughout the world. As unmanned aircraft can house high-powered, digital cameras that operate in the visual, infrared, and low-light spectra[70] privacy concerns seem to be

[65] For instance the ongoing mandating for aircraft operating in controlled airspace to be fitted with ADS-B satellite based systems.

[66] See for examples Ravich, Timothy 'The Integration of Unmanned Aerial Vehicles into the National Airspace' (2009) 85 *North Dakota Law Review* 597; Stefan Kaiser, 'UAVs and Their Integration into Non-segregated Airspace' (2011) 36(2) *Air and Space Law* 161; Masutti, Anna 'Proposals for the Regulation of Unmanned Air Vehicle Use in Common Airspace' (2009) 34 *Air and Space Law* 1; Jeronimo Inacio Nunes, 'Unmanned Aerial Systems: Access to Brazilian Airspace' (Paper presented at the ICAO Regional Unmanned Aircraft System Seminar, Peru 18-20 April 2012); Jim Coyne, 'CASA UAS Regulatory Developments' (Paper presented at the ICAO Regional Unmanned Aircraft System Seminar, Peru 18-20 April 2012); John Walker, 'Unmanned Aircraft System Integration in the National Airspace System Project' (Paper presented at the ICAO Regional Unmanned Aircraft System Seminar, Peru 18-20 April 2012), John Walker, RTCA Special Committee, 203 'UAS Global Airspace Integration' (Paper presented at the ICAO Regional Unmanned Aircraft System Seminar, Peru 18-20 April 2012); Leslie Cary, 'International Regulatory Framework for Remotely Piloted Aircraft Systems' (Paper presented at the ICAO Regional Unmanned Aircraft System Seminar, Peru 18-20 April 2012); Klaus Wohlers, Rheinmetall Defence, 'Certification of RPA' (Paper presented at the ICAO Regional Unmanned Aircraft System Seminar, Peru 18-20 April 2012); Mike Lissone, EUROCONTROL, 'Paving the way towards UAS ATM integration' (Paper presented at the ICAO Regional Unmanned Aircraft System Seminar, Peru 18-20 April 2012).

[67] Kaiser, Stefan 'Third Party Liability of Unmanned Aerial vehicles' (2008) 57 *Zeitschrift für Luft- und Weltraumrecht* 229, 233.

[68] Kaiser, S 'Legal Aspects of Unmanned Aerial vehicles' (2006) 55 *Zeitschrift für Luft- und Weltraumrecht* 344, 352.

[69] McCormick, John 'Development of UAS in Civil airspace and challenges for CASA' (Speech delivered at the Association for Unmanned Vehicle Systems Australia, Melbourne, 25 February 2013) < http://www.casa.gov.au.

[70] UTC Aerospace Systems, TASE400 and 400D Cloud Cap Technology <http://www.cloudcaptech.com/gimbal.

well founded. In the U.S. concerns over privacy has caused delays to a number of the U.S. Government mandated deadlines set by *FAA Modernization and Reform Act of 2012*.[71]

Although invasion of privacy is just one of many areas in which existing laws are challenged it is the area that this paper will focus upon. The reason for a concentration on this area of the law is because this paper argues – at least in Australia – that the UAS activities that can cause most invasion to privacy are those operated in populous areas, at low levels (for example, below 400 feet AGL) and with small or micro UAS. And this is the precise type of UAS activities that this paper argues, may be outside of the scope of current UAS regulations because of Constitutional limitations. As all legal jurisdictions are different, the discussion necessarily is restricted to a consideration of Australia's legal system. To attempt a broader legal analysis and review would therefore be a futile exercise and certainly beyond the competency and expertise of the writer.

Dealing with matters related to privacy is not part of CASA's role. The right to privacy in Australia is governed federally by the *Privacy Act* 1988[72] and is regulated by the Australian Privacy Commissioner. Recently the Privacy Commissioner raised the issue of privacy with the Attorney General to highlight the threats to citizens' privacy from UAS, and suggested a review of the current privacy regulatory framework.[73] The Commissioner conceded that whilst the *Privacy Act* governs how a government agency or commercial entity employing UAS is to collect, store, use, disseminate and protect a citizen's personal information, that legislation does not extend to protect citizens from private individuals who collect personal information using UAS.[74]

Notwithstanding, the Privacy Commissioner did acknowledge that there was State and territory legislation, although possibly insufficient and seemingly inconsistent,[75] relating to 'unlawful surveillance, stalking and harassment that may apply to the use of . . . [UAS] by individuals.'[76] The Privacy Commissioner recommended that all levels of government "to review their privacy and surveillance legislation to ensure it covers the use of . . . [UAS] technology".[77] This initiative led to the Commonwealth tasking the House of Representatives Standing Committee on Social Policy and Legal Affairs to undertake an inquiry into the regulation of Unmanned Aerial Vehicles. This inquiry and its report are detailed later in this section.[78]

CASA has repeatedly stated that "matters related to privacy is not part of its role; it is a matter for the Australian Privacy Commissioner".[79] However, CASA believes that the UAS community can play a critical role in educating the broader public and engaging in meaningful dialogue with them to demonstrate the positive aspects of UAS technology and the benefits that can be

[71] Dillingham, Gerald '*Unmanned Aircraft Systems: Continued Coordination, Operational Data, and Performance Standards Needed to Guide Research and Development*' 2013, http://www.hq.nasa.gov/leg (viewed 3 May 2014).
[72] *Privacy Act 1988* (Cth)
[73] Australian Privacy Commissioner, Correspondence: Attorney General: *Regulation of drone technology September 2012* (September 2012) Office of the Australian Information Commissioner <http://www.oaic.gov.au/news-and-events/statements/privacy-statements/regulation-of-drone-technology/correspondence-attorney-general-regulation-of-drone-technology-september-2012>.
[74] Ibid.
[75] See Australian Privacy Commissioner, above, for reference to 'possibly insufficient' legislation. See ABC Online, *Drones fly through privacy law loophole* (14 September 2012) ABC News <http://www.abc.net.au/news/2012-09-13/drone-technology-prompts-privacy-law-review-call/4260526> for reference to 'seemingly inconsistent' legislation.
[76] Australian Privacy Commissioner, Mr Timothy Pilgrim.
[77] ABC Online, Op. cit.
[78] House of Representatives Standing Committee on Social Policy and Legal Affairs 'Eyes in the sky: Inquiry into drones and the regulation of air safety' The Parliament of the Commonwealth of Australia, Canberra, July 2014. See section 1.5.4.
[79] CASA Deputy Director of Aviation Safety, Mr Terry Farquharson.

provided to society.[80] It remains to be seen how CASA will improve regulation over the 'operation of unmanned aerial vehicles'[81] without duly considering the impact of privacy concerns on UAS aviation-safety regulations, especially given the delays being experienced by the FAA to achieve its government's corresponding mandate have arisen primarily due to privacy concerns.

The key consideration in respect of privacy protection is foremost to protect citizens' rights to privacy by reviewing and aligning relevant legislation. Nominating the interrelationship that must exist between CASA, the Office of the Australian Information Commissioner, and other key stakeholders would facilitate that review and alignment, and subsequent development of UAS aviation-safety regulations.

While ICAO provides a forum to coordinate air safety issues, member States must consider domestic implications from use of UAS, including the privacy of its citizens. Generally, the international norm for privacy flows from Article 12 of the *Universal Declaration of Human Rights 1948*, which provides that '[n]o one shall be subjected to arbitrary interference with his privacy. The issue that arises is whether UAS are permitted to operate in national airspace over public places (such as parks and beaches) and if so, will there be a requirement for UAS to avert its 'eyes' from the ground?

In the United States, commentators have argued that interference with privacy would contravene the U.S. Constitution's Fourth Amendment, in that it protects U.S. citizens against unreasonable searches and seizures.[82] In this context, the FAA held public consultations in April 2013 to seek comment on draft privacy provisions for its UAS test site. While the FAA does not intend for the privacy provisions to apply more generally across non-segregated airspace, it may inform future discussions on how law, policy and industry practice should respond in the longer term.[83]

Unfortunately in Australia, the issue remains unaddressed, even in the aftermath of the recommendations of the 'Eyes in the sky' inquiry into UAS and the regulation of air safety. The Australian Privacy Commissioner recently commented that the *Privacy Act 1988* (Cth) does not contain provisions dealing with invasion of privacy from individuals operating UAS. CASA similarly acknowledges the regulatory gap between CASA's focus on air safety and the wider Commonwealth's legislative responsibility to ensure privacy of its citizens.[84] However, there are possibly other provisions[85] that CASA can use to enforce privacy, which prohibits the operation of a UAS over a populous area unless the UAS can clear the area in the event of a component failure. As will be highlighted later in this paper, the area of most concern is in situations where the operation of UAS is outside of navigable airspace, and by virtue of the aircraft design, is incapable of operating in navigable airspace.

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[80] ABC Op. cit.
[81] *National Aviation Policy White Paper*, p. 115.
[82] Roberts, Troy 'On the Radar: Government Unmanned Aerial Vehicles and their Effect on Public Privacy Interests from Fourth Amendment Jurisprudence and Legislative Policy Perspectives' (2009) 49 *Jurimetrics* 491, pp 499-508; Travis, D 'We've Got Our Eyes on You: When Surveillance by Unmanned Aircraft Systems Constitutes a Fourth Amendment Search' (2009) 51 *South Texas Law Review* 173, pp. 197-204.
[83] FAA, 'Online Session on UAS Test Site Privacy Policy', (online transcript), 3 April 2013, <http://www.faa.gov/about/initiatives/uas/media/UAStranscription.pdf>.
[84] Griffith, C 'Drones a safety and privacy headache', *The Australian* (online), 18 July 2013, <http://www.theaustralian.com.au/australian-it/personal-tech/drones-a-safety-and-privacy-headache/story-e6frgazf-1226681074927>; Background Briefing, 'Drones fly through privacy loophole', *ABC News* (online), 14 September 2012, <http://www.abc.net.au/news/2012-09-13/drone-technology-prompts-privacy-law-review-call/4260526>.
[85] See CASR 1998 sub-regulation 101.280.

Notably, the Australian Law Reform Commission is undertaking an Inquiry into 'Serious Invasions of Privacy in the Digital Era' and will review, among other things, the growth in capabilities to use surveillance and communication technologies and community perceptions of privacy.[86] As privacy considerations through the use of UAS gather momentum in other jurisdictions, hopefully this will generate a similar impetus in Australia to review the *Privacy Act* in the near future.

1.6.2 Common law protection of privacy

The torts of trespass to land and private nuisance correlate insofar as they both pertain to interference with an occupier's exclusive use of land, with trespass to land relating to direct interference with that exclusivity and private nuisance relating to indirect interference.[87] As the common law and legislation in Australia have modified application of *cujus est solum ejus est usque ad coelum*,[88] in the case of trespass to land no action will arise against unmanned aircraft overflying an occupier's land at 'normal, prudent cruising levels'.[89]

In respect to UAS activities a possible cause of action may arise against the operator of an unmanned aircraft that overflies land at a sufficiently low level such that it interferes with the occupier's 'ordinary use and enjoyment'[90] of that land even in the presence of CASA-approved exemptions for low-level flying. Similarly, private-nuisance action may arise against the operator of an unmanned aircraft that flies over or in proximity of an occupier's land at lower-than-permissible levels, including when taking off and landing. Even at normal altitudes a private-nuisance action may arise when substantive damage exists.[91] However, where the UAS operator can show that the act was done by a stranger or pursuant to statutory authority, the private-nuisance action is unlikely to succeed.[92]

The key consideration in the torts of trespass of land and private nuisance relates to UAS operating from semi-prepared or ad hoc areas, which raises the question as to how an occupier of land levies the above tortious actions against UAS operators if those operators are not readily identifiable by their unmanned (and unmarked) aircraft.[93]

As an unmanned aircraft could be used by an operator to stalk or harass citizens, in the same ways that would breach a citizen's right to privacy, governments and the courts should each consider the provisions needed within Australia's body of criminal law to accommodate these acts of intimidation when specifically performed using UAS.[94]

[86] Australian Law Reform Commission, 'New Commissioner appointed to the ALRC for Serious Invasions of Privacy Inquiry', (online media release), 30 July 2013, <http://www.alrc.gov.au/news-media/media-release/new-commissioner-appointed-alrc-serious-invasions-privacy-inquiry>.
[87] Bartsch, Ronald I C *Aviation Law in Australia* (Thomson Reuters Australia, 4th ed, 2013) paras 5.260, 5.295.
[88] Ibid para 5.260.
[89] Ibid para19.130.
[90] Ibid quoting *Baron Bernstein of Leigh v Skyviews & General Ltd* [1978] QB 479.
[91] Ibid para 19.90, 19.135, which provides that substantive damage can comprise the impact of noise, or impact on endangered fauna or livestock.
[92] Ibid para 5.295.
[93] *Civil Aviation Safety Regulations 1998* (Cth) reg 101.015 states that operators of unmanned aircraft with a launch mass of below 150 kg do not require registration or other markings.
[94] Dolan, Alissa and Thompson, *Integration of Drones into Domestic Airspace: Selected Legal Issues* (Report No R42940, U.S. Congressional Research Service, 2013) 29 <http://www.fas.org/sgp/crs/natsec/R42940.pdf>.

1.6.3 Commonwealth and State privacy laws

The various States and territories have laws relating to privacy[95] but most of these are limited in much the same way as the federal *Privacy Act 1988*. The laws generally apply to the activities of State and territory government agencies and tend to be limited to those entities. There is also a range of additional laws that may protect against invasive or inappropriate use of UAS. For example, each State and territory has legislation that may make it illegal in certain circumstances to use a surveillance device to record or monitor private activities or conversations via listening devices, cameras, data surveillance devices or tracking devices.

The Commonwealth *Surveillance Devices Act 2004* regulates the lawful use of surveillance devices by federal law enforcement agencies but does not contain prohibitions on the use of surveillance devices, as is the case with some of the laws of the States and territories. Moreover, each States and territory government take varying approaches to their surveillance devices prohibition laws.[96] Four of the jurisdictions have surveillance devices laws and four have listening devices statutes that are simply not appropriate for modern communication technology let alone rampaging UAS technology.

1.6.4 'Eyes in the Sky' Inquiry

In December 2013 the Commonwealth Parliament's House of Representatives Standing Committee on Social Policy and Legal Affairs was tasked with undertaking an inquiry the regulation of Unmanned Aerial Vehicles.[97] The inquiry was chaired by Mr. George Christensen MP with Ms. Sharon Claydon MP as the Deputy Chair together with nine sitting representatives. The resulting report entitled: 'Eyes in the sky: Inquiry into drones and the regulation of air safety' was handed down in July 2014.[98]

The inquiry reviewed the emerging issues around UAS use and the examined the adequacy of the existing legal and regulatory framework with a particular focus on safety, privacy and security issues. During a series of hearings and roundtables, the Committee heard from CASA about the importance of allowing UAS technology to mature so that the risk to people and property is minimised. The Committee also heard from privacy experts, including the Commonwealth Privacy Commissioner, Mr Timothy Pilgrim, about the complexities and gaps in Australia's privacy laws and the inadequacy of law – both federal and State – to protect individuals against privacy invasion from UAS activities.

As was discussed in the previous section the primary legislation for the control of privacy issues in Australia is the Commonwealth *Privacy Act 1988.* This statute provides a number of privacy protections to the Australian public and applies to most Australian government agencies and many private sector organisations. The thirteen related 'privacy principles' govern how

[95] *Listening Devices Act 1992* (ACT); *Surveillance Devices Act 2007* (NSW); *Surveillance Devices Act* (NT); *Invasion of Privacy Act 1971* (Qld); *Listening and Surveillance Devices Act 1972* (SA); *Listening Devices Act 1991* (Tas); *Surveillance Devices Act 1999* (Vic); *Surveillance Devices Act 1998* (WA).

[96] For a comprehensive account of the various State and Territory laws as they relate to UAS activities see: Butler, Des 'The Dawn of the Age of the Drones: An Australian Privacy Law Perspective", *UNSW Law Journal*, Volume 37(2), 2014.

[97] Inquiry was initiated in response to a matter arising from the 2012-13 Annual Report of the Office of the Australian Information Commissioner.

[98] House of Representatives Standing Committee on Social Policy and Legal Affairs 'Eyes in the sky: Inquiry into drones and the regulation of air safety' The Parliament of the Commonwealth of Australia, Canberra, July 2014.

organisations should collect, use, disclose, provide access to and secure personal information. However, the Act does not provide Australians with comprehensive privacy protections.

In particular the *Privacy Act* does not apply to the collection and use of personal information by private citizens and does not provide overarching privacy protection for the individual. This is precisely the area where the use of small and micro UAS can result in a serious invasion of an individual's privacy. However, the Act was never designed or intended to protect against intrusions into Australians' private seclusion. Dr Roger Clark from the Australian Privacy Foundation told the inquiry:

> We identify privacy of personal behaviour . . . as the interest that people have in not being intruded upon by undue observation or interference with their activities, whether or not data is collected – after which it would then move into another space. When we look at the Privacy Act . . . it is all but irrelevant to behavioural privacy protection. It was designed that way; it was designed to deal with data protection only.[99]

So although the *Privacy Act* offers substantial privacy protections in certain circumstances there are a number of situations in which it may not protect Australians against the invasive use of UAS. The Committee concluded that issues arising from the expanding use of UAS would require significant changes to both federal and State privacy law.

The Australian Law Reform Commission's Professor Barbara McDonald agrees with the inquiry's findings in that the exemptions[100] contained within the Act and the 'patchwork' of State and federal privacy laws are totally inadequate to deal with UAS operations:

> At the moment the lack of uniformity means that there is insufficient protection of people's privacy, because people do not know what is against the law and what is not. But it is also insufficient protection for organisations like those in the media. [101]

The report made five recommendations in respect to privacy issues arising from the inquiry. The first suggested that CASA should provide more information to users and manufacturers regarding privacy issues. The second recommended that the Australian Government consider introducing legislation by July 2015 to provide protection against privacy-invasive technologies and to consider the Australian Law Reform Commission's proposal for the creation of a tort of serious invasion of privacy.[102]

The three other recommendations by the Committee were that the Australian Government should:

- initiate action to simplify Australia's privacy regime by introducing harmonised Australia-wide surveillance laws

[99] Committee Hansard, 28 February 2014, p. 39.
[100] Significantly the *Privacy Act (1988)* contains exemptions for a number of groups including small businesses (with an annual turnover of less than $3 million), political organisations, media organisations, and individual citizens acting in the course of their personal, family or household affairs are not subject to the privacy principles.
[101] O'Sullivan, Emma 'Eyes in the Sky: New Technologies Present New Challenges for Law Makers' August (2014) *About the House* p. 47.
[102] The Australian Law Reform Commission has since outlined a proposed remedy in a discussion paper on serious breaches of privacy in the digital era, which involves a new tort of privacy. If such a proposal was put into law, a person could sue for a serious invasion of privacy, if their 'seclusion or private affairs' were intruded upon, or if private information about them was misused or disclosed.

- consider the measures operating to regulate the use or potential use of RPAs by Commonwealth law enforcement agencies for surveillance purposes in circumstances where that use may give rise to issues regarding a person's seclusion or private affairs.
- co-ordinate with the Civil Aviation Safety Authority and the Australian Privacy Commissioner to review the adequacy of the privacy and air safety regimes in relation to remotely piloted aircraft, highlighting any regulatory issues and future areas of action. This review should be publicly released by June 2016.

The above recommendations are quite broad and if implemented could have far-reaching effects and would presumably go a long way toward addressing the potential privacy issues. There is, however, one very important proviso. That is, that the Commonwealth Parliament does in fact have the legal authority to pass any such legislation required. As will be contended in Part 2 of this paper, there are aspects of UAS activities, especially those that are most likely to impinge upon privacy concerns, that are subject to Constitutional limitations and therefore (as it will be argued) are beyond the scope of the Commonwealth's powers.

1.6.5 Other legal issues

Invasion of privacy is not the only legal issue confronting society in respect to UAS operations – it is just the most apparent and confronting issue. The issue of accident responsibility and liability involving UAS is another important area of the law and one that is not adequately addressed by either the ICAO guidance material or regulations developed by any national aviation authority. Annex 13 of the Chicago Convention defines an accident as '[a]n occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked, in which . . . [inter alia] a person is fatally or seriously injured".

While a collision between a manned aircraft and a UAS would comply with the definition of an "accident", the collision of two UASs or the impact of an UAS with property or equipment would not be addressed under the current legal framework. Notably, the ICAO Technical Commission discussed this issue at the 36th Assembly, stating that, despite the best efforts of regulators, manufacturers and operators, accidents will occur.[103]

The United Kingdom CAA guidance on this issue indicates that while the strict definition of "accident" or "incident" may not apply to UAS, Appendix B to CAP 382 sets out the types of "reportable occurrence" that may apply specifically to UAS, including loss of control or data link, navigation failures, structural damage and flight programming errors.[104]

Increasing the complexity of apportioning liability, the question arises – would the operator or the manufacturer is at fault for UAS operating in autonomous mode? Moreover, if an UAS was operating autonomously on defective software, does this reduce a human operator's responsibility for failure to detect and avoid?[105] The legal issue that arises is whether the causal link between the operator's action (or omission) and the resulting UAS accident is solid enough

[103] ICAO, 36th Technical Commission Assembly, Agenda Item 30: Addressing Unmanned Aircraft System Accident Investigation and Prevention by ICAO Member States (paper presented by the United States, 18 September 2007), p. 3,http://legacy.icao.int/icao/en/assembl/a36/wp/wp217_en.pdf.
[104] CAA pp. 98-99.
[105] Nas, M 'Pilots by Proxy: Legal Issues Raised by the Development of Unmanned Aerial Vehicles' (undated), *Unmanned Aircraft Technology Applications Research*, pp 11-20, <http://www.uatar.com/Legal%20Paper>.

to remove doubt about apportioning liability.[106] Besides creating dilemmas for accident investigators and insurers, it will also be difficult for lawmakers to design a strict liability regime – currently applied to manned aircraft accidents – for UAS-specific scenarios.

Pursuant to the *Damage by Aircraft Act 1999* (Cth) most UAS operations[107] are strictly liable for 'personal injury, loss of life, material loss, damage or destruction' suffered on the surface by persons or their property, arising when impacted by either an unmanned aircraft whilst in flight, its debris or other objects falling from that aircraft.[108] Whilst the liability for surface damage by aircraft is unlimited, the last amendment to that Act has allowed for damages to be reduced where contributory negligence exists.[109]

UAS operators will be looking to insurers to mitigate this third-party liability. However, the costs of that insurance will correlate with the insurer's risk assessment of that third-party damage, with that assessment influenced by the UAS design and its integrity, overall safety record of UAS operations, and regulatory and certification criteria governing those operations.[110] As unfavourable or uncertain assessments give rise to either high premiums or a refusal-to-insure, this could restrict the growth of the Australian UAS market.[111] Consequently, issues should be resolved over the unfavourable or uncertain nature of those risk assessments. However, as regulatory and certification criteria influence those assessments, and development of such criteria has yet to occur to any great extent in Australia, resolution of those issues is expected to be iterative in nature.

The UAS sector should engage with the aviation-insurance industry to resolve these insurance-risk issues. Further, given the Government has made a commitment that it would "develop a scheme to make insurance for third party surface damage compulsory",[112] the Department of Infrastructure and Transport should be included as a key stakeholder. Finally, considering the interdependence between this liability-insurance issue and the pending UAS civil aviation safety regulations, CASA should also be included as a key stakeholder.

Although there are a myriad of other legal related issues arising from the operation of UAS this is not the specific focus of this research. Part 1 of this research paper has attempted to provide and overview of the emergence of UAS operations into the civil aviation industry and provide an awareness of some of the main issues – technical, legal and ethical – that this transition has created in the broader community.

A review of the development of aviation regulation in response to periods of rapid increase in aircraft technology provides a valuable insight into the magnitude of what we now face in terms of the integration of UAS operations into civilian operations and into society in general. Part 2 of this paper considers the development of aviation legislation in respect to unmanned aircraft from a historic perspective and then looks at the specific measures taken by internationally by the

[106] Diederiks-Verschoor, I *An Introduction to Air Law* (7th Ed, 2001), p. 137.
[107] Bartsch, R Op. cit. para 18.45 states: purely intrastate flights may still be covered by the State [damage-by-aircraft] legislation, especially those intrastate flight operations conducted by "natural persons" rather than by "corporations".
[108] *Damage by Aircraft Act 1999* (Cth) ss 5, 10, 11.
[109] *National Aviation Policy White Paper* Ibid s 11A.
[110] Kaiser, Stephen 'Third Party Liability of Unmanned Aerial Vehicles' (2008) 57 *Zeitschrift für Luft- und Weltraumrecht* 229, 234–5. Matthew DeGarmo, *Issues Concerning Integration of Unmanned Aerial Vehicles in Civil Airspace* (Report No MP 04W0000323, The MITRE Corporation, November 2004) 2-54 [2.5.1] <http://www.mitre.org/work/tech_papers/tech_papers_04/04_1232/04_1232.pdf>.
[111] DeGarmo, Op. cit.
[112] *National Aviation Policy White Paper*, Op. cit. p. 88.

ICAO and other countries and then looks at the Australian Civil Aviation Safety Authority's regulations in respect to UAS activities.

2. DEVELOPMENT OF UAS REGULATION

2.1 Introduction

Reviewing the history of the development of aviation reveal that with all previous periods of significant and rapid advancement in aircraft design, technology and capability there has always been a corresponding and commensurate response by governments in an attempt to 'harness' the new technology. The rate of development of aircraft design and performance capability during previous world wars cannot be overstated. The following extract provides an insight of the situation in the aftermath of the First World War:

> "The war was a tremendous lever for aviation. In a feverishly accelerated rhythm, at the command of the state, every door was open to discovery. Success was achieved, the aim reached, astounding progress made . . . War was the hellish laboratory in which aviation became adult and was shaped to flawless perfection."[113]

In the past the prime motivator of governments to react so swiftly and universally to such developments was not so much related to the potential commercial benefits that the technology offered but rather to curtail its capacity to cause widespread destruction and devastation. Not surprisingly, in the aftermath of the two World Wars, the intervention of governments has always been retrospective. However, the level of reaction, cooperation and almost universal agreement of governments at such times, through the convening and adoption of international conventions, was quite astonishing and remains unprecedented at least in terms of the speed and extent of the response.[114] The rapid development of aircraft capabilities and their attendant threat to society is a remarkably galvanising catalyst for universal regulatory reform.

2.2 Paris Convention 1919

As a consequence of World War I, aircraft[115] design and technology progressed at an astonishing rate. By the end of the War, and in only four years, the aeroplane had developed from a flimsy single-engine biplane to large, multi-engine, alloy construction transporters. Aircraft were now capable of flying significantly increased payloads higher and further than ever before and at previously unimaginable speeds. The number of aircraft also increased dramatically. At the beginning of the War in 1914 Great Britain possessed only 12 military aeroplanes. By the War's end in November 1918 there were 22,000 aeroplanes.[116] Civil airliners were waiting in the wings to play an important role in the advancement of world trade and commerce.

Although the commercial potential of this now vastly improved means of transportation was universally realised by states, it was more specifically the demonstrated capacity of aviation as a weapon that impelled governments to act so swiftly and harmoniously to control this potentially destructive new technology.

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[113] Bartsch, Ronald I C *International Aviation Law,* Ashgate Publishing, United Kingdom, 2012, p. 47.

[114] The Chicago Convention 1944 remains by far the most ratified international treaty with some 192 contracting states.

[115] The original definition of "aircraft" was "any machine that can derive support in the atmosphere from the reaction of the air": Art 6. In this publication the amended definition introduced by ICAO on 6 November 1967 is used in which the words "other than the reactions of air against the earth's surface" were inserted at the end of the previous definition (now revised Art 7). The modified definition covers all types of UAS – rotary and fixed wing – large and small – but precludes the inclusion of a hovercraft as an aircraft, which apparently had the effect of reducing production costs of hovercrafts by more than 50 per cent.

[116] According to Shawcross and Beaumont, *Air Law* (4th ed) Butterworths, London, 1977, p. 2.

Immediately following the end of the War in Europe, and only six months after the commencement of the first regular international passenger air service,[117] 27 states signed the *Convention Relating to the Regulation of Aerial Navigation* in Paris on 13 October 1919. The Paris Convention (as it became known) heralded the beginning of international air law in confirming, virtually at the dawn of airline operations, the desire of governments throughout the world to systematically control aviation.

With the rapid increase in the importance and prominence of civil aviation, governments were compelled to respond with regulation. The commercial impact and benefit to be derived from aviation was quite simply too important to be ignored. Furthermore, in the aftermath of World War I, the potential threat to nation states and their citizens of aircraft in hostile hands was fully realised.

Arising from discussions at the Paris Peace Conference in Versailles earlier in 1919, governments represented at this international air symposium discussed how post war civil aviation might be regulated. Agreement and co-operation amongst the allied nation representatives at the Paris Convention resulted in the Convention being signed by all delegates on 13 October 1919.

The preamble to the Convention included the words: "to encourage the peaceful intercourse of nations by means of aerial communications" and "to prevent controversy" which reflected the determination of the allied nations to agree upon consistent international legal regulation. Although initial dialogue on the topic had commenced at the Paris International Air Navigation Conference in 1910, delegates at that conference failed to reach any binding consensus. Nevertheless this earlier conference established the necessary groundwork (through dialogue and drafted technical articles) for the 1919 Convention to become the first multilateral instrument of international law pertaining to air navigation.

Additionally, the Convention provided the basis, upon ratification, of enacting the first rules relating to aviation by many of the contracting states, including Australia. The following year the Australian Commonwealth Government passed the *Air Navigation Act 1920* (Cth).[118] This statute authorised regulations to give effect to the Paris Convention.

Another most important contribution of the Paris Convention was the establishment of a mechanism to provide international technical standardisation in aviation for the first time. The International Commission for Air Navigation (ICAN)[119] was established and responsible *inter alia* for the administration and amendment of Annexes A-G to the Convention. These Annexes detailed requirements relating to specific technical issues such as aircraft registration, airworthiness certification, pilot licensing and general rules of the air. In recognition and anticipation of rapid ongoing advancements and developments in aviation, ICAN was given the authority, under the direction of the League of Nations, to amend and update the technical Annexes as it saw fit. These Annexes therefore shared the same force as the Convention itself.

In 1929 an amending Protocol of the Paris Convention introduced the term 'pilotless aircraft'

[117] The weekly service between Paris and Brussels commenced on 22 March 1919 for a fare of 365 francs. Lignes Aériennes Farman operated Farman F60 Goliath biplanes with a flying time of 2 hours 50 minutes.
[118] Number 50 of 1920.
[119] Also known as CINA, for Commission Internationale de la Navigation Aerienne.

into international aviation law[120] for the first time:

> "No aircraft of a contracting State capable of being flown without a pilot shall, except by special authorization, fly without a pilot over the territory of another contracting State" [121]

Although this amending Protocol of the Paris Convention did not come into force until 1933 it did nevertheless indicate the concern of governments of the potential of unmanned aircraft to threaten the national security of nations. According to some researchers[122] the first recorded use of drones was in 1871 when the Austrian army drop bombs in Venice using unmanned balloons.[123] It was, however, during the First World War that saw the first use of a drone in modern military warfare when the United States commissioned the design of an aerial torpedo for use against German U-boats.[124]

Later developments occurred during the Second World War when Germany employed the V-1 'flying bomb'. This set the stage for post-war UAS programs. More recently the use of drones for military applications have been directed more toward reconnaissance roles[125] such as with the United States use of the AQM-34 Firebee during the Vietnam War in a surveillance role and more recently in combat missions in Afghanistan, Pakistan,[126] Iraq,[127] and Yemen. [128]

2.3 Chicago Convention 1944

The Chicago Convention of 1944,[129] which updated and ultimately replaced the Paris Convention, is today by far the most prolifically ratified international treaty. More than 190 sovereign states have ratified[130] this convention and in so doing have agreed, under international air law, to be bound by the technical and operational standards[131] developed by the International Civil Aviation Organization (ICAO) and as detailed in the 19 Annexes.

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[120] See generally Bartsch, Ronald I C *International Aviation Law*, Ashgate Publishing, United Kingdom, 2012.
[121] This Protocol dated 15th June 1929 amended subparagraph of Article 15 to read as above and entered into force on the 17 May 1933.
[122] See: Michaelides-Mateou, Sofia & Erotokritou, Chrystel 'Flying into the Future with UAVs: The Jetstream 31 Flight'. Air & Space Law 39, no. 2 (2014): p. 113.
[123] Ibid. Aviation and aeromodelling: Interdependent evolutions and histories, Remote Piloted Aerial Vehicles: An Anthology, http://www.ctie.monash.edu/hargrave/rpav_home.html#Beginnings (viewed 17 Oct. 2013).
[124] It has been suggested by Butler (Op. cit. p. 435) that the first use of a drone in modern military warfare was when the United States commissioned the design of an aerial torpedo for use against German U-boats in World War I. The 'Speed-Scout' was manufactured by the Curtiss Aeroplane Company and launched from navy vessels and capable of carrying a 1000lb bomb. The first successful flight of the Speed-Scout was on 6 March 1918.
[125] Ibid. For example, during 2013, the U.S. army launched 21 airstrikes in Yemen, mainly from drones. The Guardian, Ackerman, S 'Barrage of drone strikes in Yemen show flaws of U.S. counter-terrorism strategy', 12 Aug. 2013, http://www.theguardian.com/world/2013/aug/12/yemen-drone-strikes-us-policy (viewed 18 Oct. 2013).
[126] Ibid. Pakistan has suffered 370 airstrikes to date. The Guardian's T. McVeigh, Investigation to record victims of U.S. drone attacks in Pakistan: 'Naming the Dead' project will name and number people killed by drone airstrikes to challenge CIA claims of no civilian deaths, 22 Sep. 2013, http://www.theguardian.com/world/2013/sep/22/journalists-website-breaks-silence-victims-drone (viewed 9 Oct. 2013).
[127] Ibid. 'Drone Wars UK, What are drones?' http://dronewars.net/aboutdrone/ (viewed 1 November 2013)
[128] For example, the Global Hawk drone was initially developed for the U.S. Air Force towards the end of the 1990 and was first used shortly after the terrorist attacks over the World Trade Centre on 11 Sep. 2001. The Verge, Franzen, C NASA's new hurricane hunters are the drones that tracked Bin Laden Scientists love the spy aircraft, but privacy concerns linger, 21 Aug. 2013, http://www.theverge.com/2013/8/21/4641352/nasa-global-hawk-drone-hurricane-science-mission-hs3 (viewed 28 Oct. 2013).
[129] Convention on International Civil Aviation, signed at Chicago on 7 December 1944. ICAO Doc 7300/9, http://www.icao.int/publications/Documents/7300_cons.pdf.
[130] Ratify means to confirm or adopt. For instance, the wording of the *Air Navigation Act 1920* (Cth) says, in effect, that the ratification of the Chicago Convention 1944 by Australia is approved. In effect the signing and ratifying of international treaties are executive acts – but in order to honour the international legal obligations, Parliament must enact the provisions of the treaty into the municipal law of Australia.
[131] As prescribed in the various ICAO standards and recommended practices or SARPS.

Relevantly, Article 8 of the Chicago Convention titled "Pilotless aircraft" provides:

> No aircraft capable of being *flown without a pilot* shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization. Each contracting State undertakes to insure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft.[132]

Despite being short and general, Article 8 has a substantial content and the following principles can be deducted from it:

- Pilotless (civilian and State) aircraft are legally considered to be aircraft, so that aviation rules apply, but the 'pilotless' element requires additional safeguards;
- As a matter of sovereignty, any over-flown State reserves the right to (not) authorize flights of (civilian and State) pilotless aircraft over its territory;
- The over-flown State has the right to determine the terms of the authorisation. It has the authority to unilaterally establish (airworthiness and flight) rules for the operation of (national and foreign, civilian and State) pilotless aircraft in its national airspace; and
- The operation of pilotless aircraft is not to compromise safety (of other civil aircraft) in all regions open to civil aircraft, not only in national airspace.[133]

The above Article clearly states that consent for flying over contracting states is only granted when several conditions are met, such as authorisation from the state to be overflown, compliance with over flight terms, the commitment of the state to be overflown to take all steps necessary to ensure that the over flight does not affect the safety of civil aircraft.[134] Therefore, there are various requirements for authorising UAS over flights. These requirements involve undertaking complex measures in order to guarantee the safety of all related operations as established by the Chicago Convention.

In respect to manned aircraft, under the Convention, all scheduled international air services[135] must also acquire prior permission before flying into or over foreign territories. It is important to point out that unlike international trade in most goods and services, which is generally *free* unless specifically restricted, trade in scheduled international air services is *prohibited* unless specifically allowed by either multilateral or bilateral air services agreements. International trade in most services is regulated by the General Agreement on Trade in Services (GATS), an agreement between members of the World Trade Organisation (WTO). In contrast, international air transport services are unique in that they are permitted if and only if "permission" or "authorisation" has been granted.

This requirement is prescribed in Article 6 of the Chicago Convention 1944 which states:

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[132] This Protocol dated 15th June 1929 amended subparagraph of Article 15 to read as above and entered into force on the 17th May 1933.

[133] For a more detailed account of these provisions see in particular Kaiser, S 'UAVs and Their Integration into Non-segregated Airspace', (2011) 36(2) *Air and Space Law* pp. 162-163.

[134] Masutti, Anna 'Proposals for the Regulation of Unmanned Air Vehicle Use in Common Airspace Complete' (2009) 34 *Air and Space Law* p. 2-3.

[135] The definition of "scheduled international air services" adopted by ICAO in 1952 requires that aircraft (a) pass through the airspace of more than one state (b) carry passengers, mail or cargo, of the general public, for remuneration (c) service two or more destinations in accordance to a published timetable or regular service. Note also that the Chicago Convention applies only to "civil" aircraft and not to "state" aircraft (Art 3(a)). Aircraft used in military, customs or police services are deemed to be state aircraft: Art 5(b).

> No scheduled international air service may be operated over or into the territory of a contracting State, except with the special permission or other authorization of that State, and in accordance with the terms of such permission or authorization.

This provision creates a legal requirement for the provision of international agreements between countries, which seek to permit airline services between them, and is usually the subject of either bilateral or multilateral agreements. Trade in ancillary aviation services is not covered under this provision. The Air Transport Services Annex of the GATS lists those air services that can be negotiated multilaterally.

The aircraft-related services currently included are:

- aircraft repair and maintenance services;
- the selling and marketing of air transport services; and
- computer reservation system services.

As UAS *are* aircraft under the ICAO presumably the provision of this Annex in respect to aircraft repair and maintenance services would also apply to unmanned aircraft. One of the fundamental principles of the GATS is that of unconditional *most favored nation* treatment and national treatment. Restrictions on trade in scheduled international air services, in contrast, are imposed bilaterally within an international framework of bilateral agreements, and are not subject to the most-favored nation principle.

Ultimately for the societal and commercial benefits that may be derived from UAS operations to be fully realised their needs to be efficient processes that allow for seamless access for international UAS air services. It is not envisaged, in respect to UAS operations, that these scheduled international air service will in the immediate future be carrying passengers, however, the carriage of freight on such services is a very real and commercially viable proposition.

Understandably the aviation community is reluctant to subject air transport fully to the GATS process. However, since the GATS came into effect in 1995 there has been a significant increase in "open skies" bilateral agreements and in establishing multilateral regional liberalisation agreements. This trend has emerged primarily as a result of the increasing global nature of international aviation and a general realisation of the limitations and inefficiencies inherent to the bilateral framework.

During the Chicago Convention to allow for easier facilitation of air services with regard to scheduled international operations most states, including Australia, the United States and Britain, signed the *International Air Services Transit Agreement.*[136] This agreement provides for both over flying rights (First Freedom) and for technical (fuel and/or maintenance) stopovers (Second Freedom) between contracting states. As such, this treaty has proven extremely effective (in terms of simplifying over flight rights) and practical when diplomatic tensions arise between contracting states, as has been the case, for example, between Australia and Iran.[137]

It is at the contracting state's unfettered discretion whether to adhere to the Transit Agreement.

[136] The Two Freedoms Agreement is also known as the Transit Agreement. This agreement was signed by 32 states at the Chicago Convention and has subsequently been ratified or accepted by over 100 states: for a more detailed account of this agreement see G Heilbronn, Aviation Regulation and Licensing: *The Laws of Australia* Lawbook Co, Sydney, Australia, 2008, pp. 288–290.

[137] In practice, although ICAO is authorised to resolve disputes arising from the Transit Agreement this is rarely invoked. The only case the ICAO Council has heard pursuant to this power was in 1950 between Pakistan and India.

Bilateral agreements can, and usually do, include terms exchanging these two freedoms. This is an alternate arrangement for over flight rights where one or both states are not party to the multilateral agreement. For instance, Australia's bilateral air services agreement with Indonesia, where Indonesia is not party to the multilateral agreement. The Transit Agreement does not specifically require contracting states to obtain a permit prior to exercising transit or non-traffic stopovers. In practice, irrespective of how over flight rights have been established, the filing of an international flight plan for operational purposes is usually all that is required to provide the requisite safety, technical and security information. Ultimately, this is the same objective that is sought for UAS operations to facilitate the benefits they too can confer upon society.

Returning to Article 8 of the Chicago Convention concerning 'pilotless aircraft' it is important to consider the details and content of the "authorisations" required for remotely piloted aircraft. To attain such authorisations and to ensure that the over flight does not affect the safety of other civil aircraft, it has been suggested[138] that the international regulations required of manned aircraft must also apply to RPA. An equivalent level of safety can only be *guaranteed* if RPAS comply with the same relevant technical standards for manned aircraft, for example, in Articles 20 et seq. and 29 et seq. of the Convention as well as the various applicable Standards and Recommended Practices (SARPs) contained within the ICAO Annexes. The previously mentioned articles prescribe, for example, the possession of an airworthiness certificate, an appropriately licensed crew, flight papers, etc., as well as the contracting states' acknowledgment of their validity.

It is also important that the rationale of the legislative drafters for the inclusion of these provisions relating to 'pilotless aircraft', namely Article 15 of the Paris Convention and Article 8 of the Chicago Convention, be clearly understood. In both World Wars remotely controlled and uncontrolled (autonomous) aircraft had been utilised by both civilian and military forces.[139] The phrase "flown without a pilot" therefore refers to instances where there is no pilot *onboard* the aircraft.

The Preamble of the Chicago Convention proclaims that civil aviation should be developed in a "safe and orderly manner and that international air transport services may be established on the basis of equality of opportunity and operated soundly and economically". UAS should therefore not be used in a manner contrary to the overall objective of the Convention. Admittedly the Preamble is not legally binding, although it has been suggested[140] that over time, it has not only acquired a consensual value but more importantly may have become apart of customary international law.

2.4 ICAO approach to developing UAS standards

Admittedly with the establishment of the International Civil Aviation Organization (ICAO) in 1944[141] and with it the proliferation and universal acceptance of its technical, safety and operational standards, the mechanism exists to ensure UAS – as with all other technological

[138] Masutti, Anna 'Proposals for the Regulation of Unmanned Air Vehicle Use in Common Airspace' (2009) p. 2.
[139] See: Gogarty, B and Hagger, M 'The Laws of Man over Vehicles Unmanned: the Legal Response to Robotic Revolution on Sea, Land and Air' (2008) 19 *Journal of Law, Information and Science* 73. The authors provide a detailed account of both the military and civil applications of unmanned systems.
[140] Michaelides-Mateou, Sofia & Erotokritou, Chrystel 'Flying into the Future with UAVs: The Jetstream 31 Flight'. *Air & Space Law* 39, no. 2 (2014): pp. 115-116.
[141] ICAO was initially established as the Provisional International Civil Aviation Organisations (PICAO) in 1944 immediately following the Chicago Convention. With the ratification of the Convention by the 26th signature state in 1947 the ICAO officially came into being.

developments in civilian aviation – are effectively and safely accommodated. ICAO in the past has developed relevant SARPs to accommodate the introduction on new technologies within the international aviation sector.

In respect to the development of UAS specific SARPs the ICAO has adopted an entirely different, and indeed novel approach, as to how these universal standards will be developed. In the context of gaining harmonised UAS standards across all convening states to the Chicago Convention is important that the process that the ICAO has adopted is clearly understood. In the past, in respect to the development of any new technical standards relating to international air transportation, SARPs have always been developed in advance and these standards is the basis upon which international standards are promulgated. In respect to UAS standards ICAO has developed guidance material[142] that will assist states develop their own regulations so they can be incorporated into their domestic civil aviation law.

On 23 May 2006 the ICAO convened an exploratory meeting on UAS in Montreal. The objective of this meeting was to determine the potential role of ICAO in UAS regulatory development work. The meeting agreed that, although there would eventually be a wide range of technical and performance specifications and standards, only a portion of those would need to become ICAO SARPs. It was also determined that ICAO was not the most suitable body to lead the effort to develop such specifications. However, it was agreed that there was a need for the harmonization of terms, strategies and principles with respect to the regulatory framework and that ICAO should act as a focal point.

ICAO was also aware of the tendency emerging in Europe to move towards a "system" certification – one that is not limited to just UAS – appears to be justified in the light of how UAS function. The system's complexity and the need to reach a shared solution regarding the criteria and principles to be adopted for drafting technical regulations for the use of UAVs have persuaded EU authorities to involve other competent bodies in this sector.[143] The European Organisation for Civil Aviation Equipment (EUROCAE) was tasked to form a working group on UAS airworthiness certification and operation approval.[144]

Following on from the successful outcomes of the 2006 ICAO meeting a subsequent informal meeting was held on the 11 January 2007. This meeting further developed technical specifications for UAS operations and considered the work in this area by both the RTCA and EUROCAE that was being coordinated through a joint committee of the two working groups. The main issue for ICAO related to the need to ensure safety and uniformity in international civil aviation operations. In this context, the delegates agreed that there was no specific need for new ICAO SARPs at such an early stage. However, there was a need to harmonize notions, concepts and terms. Most importantly the meeting also resolved to set up a study group specifically to consider UAS.[145]

2.4.1 ICAO Unmanned Aircraft Systems Study Group

In 2007 the ICAO established the Unmanned Aircraft Systems Study Group (UASSG) to consider, *inter alia,* how best to develop UAS standards. The UASSG was established by the in

[142] Full citation to ICAO RPA Guidance material and date March 2015 *Remotely Piloted Aircraft Systems Manual (RPASM)* ICAO Doc 10019. See later heading "Remotely Piloted Aircraft Systems Manual".
[143] For a more detailed account of the 'systems based' regulatory approach see: R09 P 5
[144] WG-73: Unmanned Aerial Vehicle – Working Paper, 25 Oct. 2006.
[145] ICAO Exploratory Meeting on Unmanned Aerial Vehicles, Montreal, 23-24 May 2006, ICAO-UAV WP/2.

response to the perceived urgent need for the harmonisation of terms, strategies and principles with respect to UAS operations.

The terms of reference of the UASSG were described as follows:

> In light of rapid technological advances, to assist the Secretariat in coordinating the development of ICAO Standards and Recommended Practices (SARPs), Procedures and Guidance material for civil unmanned aircraft systems (UAS), to support a safe, secure and efficient integration of UAS into non-segregated airspace and aerodromes.

Most importantly ICAO stressed that the introduction of remotely piloted aircraft into non-segregated airspace and at aerodromes should in no way increase safety risks to manned aircraft. The overall objective of the UASSG was therefore to provide the basis for global harmonisation of terms, strategies, concepts and principles needed to support the integration of remotely piloted aircraft in non-segregated airspace. The UASSG was structured in such a manner to allow for a phased approach to the development of UAS regulations by states and to provide sufficient time and opportunity for UAS-related issues to be discussed in an international forum.

The UAS Study Group initially had representatives of eighteen states (Austria, Australia, Brazil, Canada, China, Czech Republic, France, Germany, Italy, Netherlands, New Zealand, Norway, Russian Federation, Singapore, South Africa, Sweden, UK, and USA), as well as representatives from European Aviation Safety Agency (EASA) and EUROCONTROL and nine international organisations (CANSO, EUROCAE, IAOPA, ICCAIA, IFALPA, IFATCA, NATO, RTCA, and UVS International).

In the six years from the time of its establishment until its disbandment in mid-2014 to allow for the establishment of a dedicated ICAO Panel, the UASSG had concentrated its efforts on the development of a regulatory framework for UAS or, in the terminology adopted by the ICAO, remotely piloted aircraft systems (RPAS). The UASSG had during that time been the focal point within ICAO for facilitating the development of a regulatory framework that will eventually allow UAS to be integrated into non-segregated airspace and at aerodromes, alongside manned aircraft.

Under the Chairmanship of the then senior CASA manager, Mr James Coyne,[146] the UASSG worked collaboratively with other expert groups within ICAO as well as external standards-making organisations. During the six years of its operation UASSG served as the high level focal point for global interoperability for the development of UAS regulatory standards.

The UASSG typically held three meetings each year and was attended by approximately 50-60 participants with the June 2013 meeting reaching a record of 66 participants. Delegates came from a diverse range of backgrounds and expertise. The meetings provided the opportunity to ensure work on the various topics moved forward in an orderly manner and remained consistent with the existing regulatory framework provided by the Chicago Convention.

As the UASSG delved into the subject of UAS and considered how these new systems would align with the existing international regulatory framework, two critical items elements Article 8 of the Chicago Convention were identified, namely:

[146] Mr Jim Coyne is the Technical Director of the international consultancy firm UAS International Pty Ltd that provides global UAS solutions across all facets of the sector.

1. the fact that *any* aircraft flown without a pilot on board is 'pilotless'; and
2. a requirement that such aircraft be 'controlled'.[147]

The 'control' referred to in Article 8[148] must further be exercised by a *person*, however, this person may not necessarily be a pilot in the traditional sense of the term.[149] The focus of work undertaken by the UASSG therefore centred on 'remotely piloted aircraft systems' (RPAS) which comprises of the remotely piloted aircraft (RPA), their associated remote pilot station(s) (RPS), command and control links (C2) and any other components identified in the type design. The aircraft are flown by 'remote' pilots who will hold a 'remote' pilot licence which is different from pilots of manned aircraft although similar knowledge, skills and training is envisaged. It was considered that the medical requirements would be more akin to those of air traffic controllers.[150]

Unlike many previous domestic UAS programs, the UASSG limited its focus upon:

- international aviation operations beyond visual line-of-sight (VLOS) and under instrument flight rules (IFR);
- controlled airspace; and
- controlled aerodromes.

The UASSG first considered introducing the term 'remotely piloted' at its third meeting in September 2009 after reaching the conclusion that only unmanned aircraft that are *remotely piloted* could be integrated alongside manned aircraft in non-segregated airspace and at aerodromes. From that time on the UASSG decided to narrow its focus from *all* unmanned aircraft systems to those that are remotely piloted.

This international organization was requested to establish this group by Member States and, in particular, by EU countries, which have encouraged the organization to define its role in the creation of a set of regulations for this sector in order to harmonize terminology, principles and strategies for the sector's future regulation. As a result, it has been suggested that the ICAO Annexes be reviewed in order to introduce new Standards and Recommended Practises for this kind of aircraft. The UASSG examined the guidelines of the aforementioned UAV Study Group, stressing that they adequately address the many issues that have been raised. In particular, a proposal has been made to change the term UAVs into Unmanned Aircraft System (UAS) because it may be more difficult to insert UAVs into national regulatory regimes.

This decision also has significant ramifications in terms of legal liability. If an aircraft system is operated fully autonomously then the issue of who is responsible for its operations comes into question. Traditionally, with manned aircraft, the pilot in command or aircraft commander was usually the person ultimately responsible for its safe operations. Sometimes the aircraft operator or the registered owner may also be held responsible. Obviously, in the case of autonomous aircraft operations, the question of determining who is to be held responsible for its operations raises some challenging legal issues.

During the previously mentioned ICAO meeting of 11th January 2007 it was also agreed that

[147] ICAO Assembly (Doc 7300)
[148] See Article 8 supra.
[149] That is not an Article 32 'pilot' under the Chicago Convention.
[150] Namely Class 3 medical standards.

ICAO should, through the work of UASSG, coordinate the development of a strategic guidance document that would guide the regulatory evolution. As with all guidance material that is non-binding in application, the guidance document would be used as the basis for development of regulations by the various states and organisations. As regulatory material developed by states and organisations gained maturity, such material could be proposed for inclusion in the ICAO guidance document. The document could then serve as the basis for achieving consensus in the later development of Standards and Recommended Practices (SARPs).

In 2008 the UASSG were instructed by ICAO's Air Navigation Commission to make a general review, and more specifically a review of ICAO Annexes, so as to find gaps between existing SARP's and those that will be needed for UAVs.[151] The working group established for this project conducted a gap analysis of existing rules with the aim of identifying suitable changes of ICAO procedures by best practice to accommodate the distinct nature of UAS operations.[152]

Acknowledging the ramped rate of UAS development, and mindful of the time taken to develop SARPs (typically 4-7 years), the ICAO decided to embark upon a novel regulatory approach. The group wanted to develop a regulatory model (in the form of guidance materials) to ensure domestic UAS operations of contracting ICAO states were adequately controlled, and furthermore, they were 'controlled' in such a manner to provide a common basis upon which internationally harmonised SARPs could subsequently be developed. It was therefore agreed that if detailed ICAO guidelines were developed, upon which individual states could 'model' their domestic UAS regulations, then this would provide sufficient structure and time in which the ICAO could develop its own UAS standards in the form of UAS specific SARPs.

One of the obvious difficulties with this approach is that UAS operations will necessarily be confined to domestic operations until such time that agreed international UAS regulations could be formulated. This may, however, present legal issues in consideration of the fact that domestic UAS operations, if operating in unsegregated civilian airspace, may 'commingle' with international air traffic. This issue is considered later in this paper.

The final meeting of the Study Group, UASSG/15, was held on 30 June 2014.

2.4.2 Amendment of ICAO Annexes

The initially step in public international law to accommodate UAS operations was contained in International Civil Aviation Organization (ICAO) Circular 328.[153] The Circular published in March 2011 set out to establish a safe, coherent and streamlined routine operation of UAS worldwide. The main objectives in the Circular were to inform states of ICAO's goals to integrate UAS into non-segregated airspace and aerodromes highlight inherent difficulties and encourage states to provide information to ICAO to contribute to its policy making.

[151] See ICAO/IMO Joint Working Group on Harmonization of Aeronautical and Maritime Search and Rescue (ICAO/IMO JWG-SAR/15-WP19, presented by the Netherlands) 12 Sep. 2008.

[152] For example, search and rescue procedures (SAR services) in Annex 12 were found to require additional procedures for ditched or crashed UAS due the peculiar nature of these activities. Given that the main objective of SAR is to save the passengers or crew of an aircraft and that in the future it would be possible for UAS to carry passengers, it is essential that procedures are established so that the authorities know whether a UAS is carrying passengers or not, perhaps by means of extra flight plan information or via ELT registers and broadcasts. It was also suggested that the relevant authorities are informed of the carrying of dangerous goods by UAS.

[153] ICAO Circular 328 AN/190. Unmanned Aerial Systems. Published March 2011. For a detailed account of this initiative see Michaelides-Mateou, Sofia & Erotokritou, Chrystel, 'Flying into the Future with UAVs: The Jetstream 31 Flight' 39 *Air & Space Law* 111 (2013/2014) p. 116.

ICAO Circular 328 dealt with three major aspects of traditional aviation: operations, equipment, and personnel. Although the Circular is not legally binding, it does serve as the basis for the publication of the ICAO RPAS Manual that is discussed below. On 7 March 2012 the ICAO Council unanimously adopted the proposed amendments to Annex 7 of the Chicago Convention.[154] The amendment also defines an aircraft that is intended to be operated with no pilot on board as an unmanned aircraft. It also provides that, with regards to the size and configuration of airframes that are different to traditional markings, the State of Registry has the authority to determine the measurement of the nationality, common and registration marks on such aircraft for easy identification purposes.[155]

In a position paper issued by the UASSG in mid-2014 it was noted that during the six years of its operation, although few UAS-related SARPs have yet been adopted, the work of the group has already led to initial harmonisation among many ICAO contracting states which have so far promulgated regulations for RPAS.[156]

Mr Jim Coyne, Chair of the UASSG recently commented that the ultimate objective of ICAO was to "develop a regime that would allow for an RPAS operator or remote pilot to file a flight plan and conduct a safe and efficient flight from one part of the world to another as a routine user of the air navigation system without impacting the safety or cost for manned aviation". To that end the work of the UASSG has been critical is establishing the foundations upon which an international UAS framework can be developed and for this vision to be realised.

2.4.3 The Remotely Piloted Aircraft Systems Manual

The final three years of the work of the UASSG was dedicated almost exclusively to the development of the *Remotely Piloted Aircraft Systems Manual (RPASM).*[157] The overall purpose of the RPASM is to provide guidance to contracting ICAO states[158] on technical and operational issues applicable to the integration of RPA in non-segregated airspace. This objective is clearly stated in the following extract:

> The objective and purpose of the manual is to provide guidance on technical and operational issues applicable to the integration of RPA in non-segregated airspace.[159]

The RPASM contains material recommended for the benefit of the entire UAS community, for example regulators, manufacturers, operators, pilots, air navigation service providers (ANSPs).[160] The scope of the RPASM is to recommend material for use by ICAO member states when establishing their regulatory framework for RPAS. The material should be used in conjunction with relevant SARPs contained in the respective Annexes. The following subjects are *not* within scope of this manual:

> a) State aircraft, without prejudice to the obligation for 'due regard' in Article 3(d) of the Chicago Convention;

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[154] Adoption of Amendment 6 to Annex 7, Ref: AN 3/1-12/- 4 Apr. 2012, http://www.icao.int/Meetings/UAS/Documents/Adoption%20of%20Amendment%206%20to%20Annex%207.pdf.
[155] Aircraft Nationality and Registration Marks 2.2 Annex 7 ICAO, Sixth Edition, July 2012.
[156] Coyne, James and Tomasello, Filippo (Co-Chairs) and Ms Leslie Cary (Secretary) UASSG.
[157] ICAO Doc 10019.
[158] ICAO Assembly Resolution A37-8: "Recognition that regional safety oversight organizations (RSOOs) have an important role in the USOAP CMA and that, wherever applicable, the word "States" should be read to include RSOOs".
[159] Section 1.4.1.
[160] Section 1.4.2

b) Autonomous unmanned aircraft and their operations including unmanned free balloons or other types of aircraft which cannot be managed on a real-time basis during flight; and

c) Model aircraft, which many States identify as those used for recreational purposes only, and for which globally harmonized standards are not considered necessary.

Accordingly the guidance provided in the RPASM applies to any RPAS (that is, UAS) used for other than recreational purposes. As previously noted the underlying premise upon which the manual was developed was to provide guidance materials that is consistent with the existing aviation regulatory framework and that will assist in the development of future UAS specific SARPs.

The first edition of the RPASM was published in advance of the ICAO RPAS Symposium, held in Montreal from 23 to 25 March 2015. Subsequent editions will be developed to follow the evolution of the regulatory framework, as it is developed. In other words the manual will be updated and expanded as knowledge is gained and material becomes mature.

2.4.4 ICAO Remotely Piloted Aircraft Systems Panel

On 6 May 2014, the Air Navigation Commission, at the second meeting of its 196th Session, agreed to the establishment of the Remotely Piloted Aircraft Systems Panel (RPASP). Because of the global importance of the work relating to RPAS, the ICAO Air Navigation Commission (ANC) decided that the UASSG is to be replaced by an RPAS Panel under its direct oversight. The work program of the panel will continue from that of the UASSG and, to a large extent, the composition of the two groups will be identical.

The Panel will continue the work on UAS that was commenced by the UASSG. The RPASP has been tasked by the ANC to achieve the following objectives:

a) serve as the focal point and coordinator of all ICAO RPAS related work, with the aim of ensuring global interoperability and harmonization;

b) develop an RPAS regulatory concept and associated guidance material to support and guide the regulatory process;

c) review ICAO SARPs, propose amendments and coordinate the development of RPAS SARPs with other ICAO expert groups;

d) assess impacts of proposed provisions on existing manned aviation; and

e) coordinate, as needed, to support development of a common position on bandwidth and frequency spectrum requirements for command and control of RPAS for the International Telecommunications Union (ITU) World Radio Conference (WRC) negotiations.

The inaugural meeting of the RPASP was held on Montreal in November 2014. The reorganisation of the internal working groups for the future work regarding SARPs development will focus on material contained in Annexes 1, 6, 8 and 10. The RPASP has established six working groups, with the following respective areas of focus:

1. Initial & continuing airworthiness, type certification, Certificates of Airworthiness
2. Command and control and spectrum issues
3. Hazard detection and avoidance, ACAS interoperability issues
4. Personnel licensing, competencies and medical issues (SARPs and PANS-TRG)

5. Operator certification and flight operations issues
6. Strategy and integration into the air navigation system

The work on the first package of SARPs to be developed by the RPASP is scheduled to be completed by early to mid-2016 to meet the timeline for review by the ANC and consultation with states. Recommendation to the ICAO Council for adoption of these SARPS is expected to occur in early 2018.

2.4.5 Summary

In summary, the very essence of aviation is travel. With rapid advancements in aircraft design and technology, largely attributable to the two World Wars, aircraft are now able to fly faster, higher and further than ever before. In no other field of human endeavour or scientific achievement have regulatory frameworks been accomplished so swiftly and with such global application than has been the case with aeronautics.

Today, in respect to UAS operations, various wars – albeit not a World War per se – have been the breading grounds for this new generation of aircraft technology that similarly requires harnessing by government throughout the world. This time, however, and perhaps unfortunately, there has been no worldwide conferences, no universal agreement, and no ensuring international treaty at the onset of the invention being transitioned into civilian usage. The fact that the overwhelming majority of civilian UAS activities are in small-unmanned aircraft may have been a factor that has contributed to lack of attention. As of the end of 2015 less than one third of all of the contracting ICAO states had enacted any form of RPAS regulation.

Under the Chicago Convention 1944 the ICAO as an international organisation is assigned the responsibility for developing and promulgating international civil aviation standards but in this instance the speed at which UAS technology has developed has allowed the phenomena to have slipped under the radar of international consciousness. It is worthwhile reflecting upon the words of a leading aviation legal commentator stated almost forty years ago:

> The use of aircraft has destroyed all effective frontier barriers, even the barrier of the ocean. So the sovereign states of the world *have been forced* to try to replace their differing systems of national laws by one international system for the flow of international traffic and trade. So far the system is still very far off. But no other system of law has been so rapidly developed by sovereign states collaborating for national and international objectives.[161] (Author's emphasis)

So are UAS about to suffer the same fate? Will governments throughout the world in response to a catastrophe of devastating proportions be 'forced' into action commensurate to the risk that this technology poses? This would appear unlikely. For the wars and 'hellish laboratories' in which drones were 'shaped to flawless perfection' have now long past. And yet the development of new, or modification of existing regulatory frameworks to protect society against their destructive and antisocial usage is still on the far, and seemingly distancing, horizon. The risks posed to society through the operation of these new types of aircrafts are well known:

> "Like any new technology, drones can be misused. They can pose a safety risk to other aircraft or to people and property on the ground, and the cameras and sensors they carry can be used to invade Australians' privacy.[162] The challenge we face is to realise the potential of this

[161] Shawcross and Beaumont, Air Law (4th ed), Butterworths, London, 1977, p. 9.
[162] The risks posed to society from UAS are indeed far broader than the terms of reference of this inquiry.

innovative technology while protecting against its risks."[163]

The underlying objective of almost all aviation related legislation is the promotion of aviation safety and security. Therefore at the most fundamental level, the regulatory challenge for operating UAS is the need to demonstrate an equivalent level of safety compared to on-board piloted aircraft.

2.5 UAS regulation in Australia

The first challenge for any aviation regulatory authority to address is that of jurisdiction over UAS and their operators.[164] While the regulatory power of some authorities such as the Australian Civil Aviation and Safety Authority (CASA) extends to smaller aircraft, including model aircraft[165] (which may be extended to small or micro UAS), other authorities do not currently regulate model aircraft and would need to expand their jurisdiction to cover small and micro UAS.[166] In some instances, this may require constitutional powers to be invoked to regulate a matter that might otherwise be outside the Authority's jurisdiction, as is the case in Australia.[167]

In terms of civilian UAS regulatory requirements, Australia has been a world leader and introduced the first certification standards in 2002.[168] As a pioneer in UAS regulation, the CASA promulgated, in 2002, Part 101 of the *Civil Aviation Safety Regulations 1998* (Cth) (CASR) and *Advisory Circular AC-101-1 (0) Unmanned Aircraft and Rockets*. Under the Australian framework, CASA only permits commercial UAS (including unmanned aircraft of more than 150 kg) to fly in Australian airspace if the operator first obtains an Operator Certificate (OC).[169]

In contrast to CASA's approach some national regulators, initially took an entirely different approach and in some instances, for example the United States, in respect to aircraft less than 150 kg were considered to be 'model aircraft' and as they operated in controlled situations (or segregated airspace) in relatively small numbers, considered that comprehensive regulation was unnecessary.[170] With the introduction in 2015 of the ICAO RPAS Manual, detailed guidance material for contracting states is now available on how to develop UAS regulations. It is envisaged that a more internationally harmonised approach will now be adopted.

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[163] From the Foreword of House of Representatives Standing Committee on Social Policy and Legal Affairs 'Eyes in the sky: Inquiry into drones and the regulation of air safety' The Parliament of the Commonwealth of Australia, Canberra, July 2014.

[164] Douglas Marshall 'Dull, Dirty and Dangerous: The FAA's Regulatory Authority Over Unmanned Aircraft Operations' [2004-2008] *Issues in Aviation Law and Policy* 10085, 10093 -10095.

[165] See CASR (1998) Part 101 that regulates model aircraft and rockets. By way of contrast see for example 14 Code of Federal Regulations (*Federal Aviation Regulations*) that differentiated between a model aircraft and a UAS. This issue has since been resolved in the handing down of the unanimous decision of full National Transportation Safety Board Office on 18 November 2014. The NTSB found that UAS are 'aircraft' within the FAA's statutory and regulatory definitions and that they are prohibited from operation in a 'careless and reckless' manner. The NTSB defined an "aircraft" as "any 'device' used for flight in the air". For a more detailed account see section 3.2.8 of this paper.

[166] Marshall, Douglas 'Dull, Dirty and Dangerous: The FAA's Regulatory Authority Over Unmanned Aircraft Operations' [2004-2008] *Issues in Aviation Law and Policy* 10085, 10100.

[167] *Airlines of NSW Pty Ltd v New South Wales (No 2)* (1965) 113 CLR 54.

[168] The world's first Operating Certificate (OC) issued to a civilian commercial operator was in Month/Year by the Australian Civil Aviation Safety Authority and signed by Mr. Rob Collins, the then Executive Manager with CASA.

[169] Civil Aviation Safety Authority, *Unmanned Aircraft and Rocket*¸ AC 101-1(0), July 2002, s 12.2.2.

[170] Ibid. International Civil Aviation Organization, *Unmanned Aircraft Systems* (2011) Circular 328 AN/190, 3; Kapnik, Benjamin 'Unmanned But Accelerating: Navigating the Regulatory and Privacy Challenges of Introducing Unmanned Aircraft Into the National Airspace System' (2012) 77 *Journal of Air Law and Commerce* 439, 441.

The CASA operator certificate granted under CASR part 101 includes restrictions to the operator in relation to the operation of unmanned aircraft. Despite the availability of exemptions, CASA's regulatory framework for UAS remains underpinned by the idea that, in order for UAS to fly within a class of airspace, they must be able to guarantee – through compliance with equipment and Air Traffic Control standards – the same (or equivalent) level of safety prescribed for manned aircraft.[171] As UAS will increasingly be operating in built up areas and eventually in non-segregated airspace, there is a need to introduce regulation to ensure they do not pose an unacceptable risk to piloted aircraft and individuals on the ground.

CASR Part 101 was first drafted nearly 10 years ago in anticipation of civil operations of UAS. At the time there was little civil operational experience to draw on from other countries and as a consequence there was limited detail included in the Regulations or Advisory Circulars relating to pilot qualifications, risk management, and airworthiness operational approval processes. Effectively, the regulation only provided a basis for CASA oversight with minimal guidance to industry. Consequently, CASA must treat every application for UAS operation as a standalone exercise, requiring significant education of applicants and a high risk of inconsistent responses that may create safety issue.

The rapid increase in activity levels and demand for CASA approvals for a range of operations from humanitarian, law enforcement, security and commercial activities increases the possibility that, without adequate guidance to industry and CASA staff, inconsistent decisions with possible adverse outcomes may result. Even in 2009 with the release of the *National Aviation Policy White Paper* there was an expectation by government that CASA would support the use of UAS through safe and consistent regulation and oversight.[172] For this reason, as was explained above,[173] an outcome-based regulatory approach provides a more efficient approach to safely accommodate the myriad of types of UAS and their increasingly diverse applications.

Aviation is an open and dynamic environment – domestically and internationally – and with UAS operations there are increasing challenges for both CASA and the UAS sector. While the needs and objectives of the stakeholders may vary, they both need to ensure that safety related considerations are at the forefront. This is one of the key challenges with the rapid growth of the UAS sector.

In February 2012, there were 15 holders of Unmanned Aircraft System Operator Certificates (UOC) in Australia operating a variety (but mostly small) remotely piloted aircraft for commercial purposes.[174] At present approximately 90 per cent of all UAS operator certificates that have been issued in Australia weigh less than seven kilograms.[175] In September 2013 this number has more than tripled to 51[176] and as of the end of 2014 that number had reached 200.[177] As shown in Figure 1 by the end of 2015 over 400 certificates had been issued by CASA or were in the process of being issued.

[171] Peterson, Mark 'The UAV and the Current and Future Regulatory Construction for Integration into the National Airspace System' (2006) 71 *Journal of Air Law and Commerce* 521, at p. 584.
[172] Commonwealth of Australia, 'National Aviation Policy White Paper' Policy Paper, Australian Government, December 2009, 1-238.
[173] See section 1.4.
[174] Presgrave, Phil 'Growth of the UAS and CASA's Focus on Safety' (Speech delivered at the Association for Unmanned Vehicle Systems Australia, Melbourne, 25 February 2013).
[175] Presgrave, Phil, Op. cit.
[176] CASA, *List of UAS operator certificate holders* (6 September 2013) http://www.casa.gov.au/scripts/nc.
[177] Meetings with CASA UAS staff in January 2015 confirmed that there were over 200 UAS operator certificates issued with another 80 applications being processed at that time.

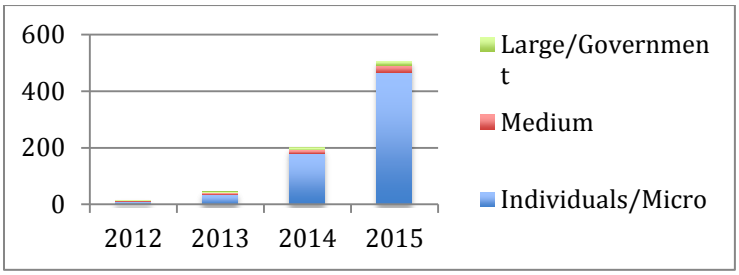

Figure 1: UAS Operator Certificates – number and type of operators

Moreover, as shown in Figure 2 below, the vast majority of operators are either individuals or small businesses. If the current trend continues, in both the number of applications and the type of operator (individuals) then it is estimated that there could be over 500 certified UAS operators by 2016.

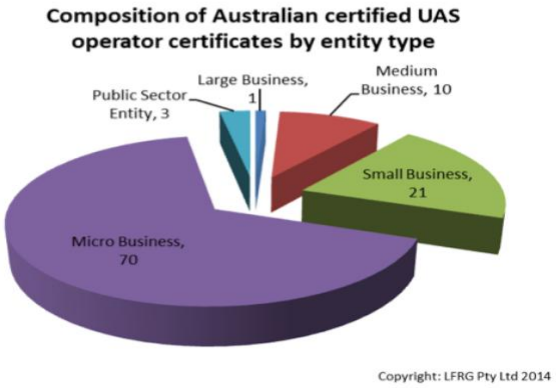

Figure 2: UAS Operator Certificates issued by CASA – type of operator

As previously stated in Part 1 of this paper in 2014 a single Australian UAS manufacturer informed the House of Representatives Standing Committee[178] that its local client base included more than 5000 customers. If these stated figures are correct, and the fact that this is the number of UAS sales in Australia from a single UAS manufacturer, the number of small UAS in the general community could be currently in excess of 50,000 units.[179] Due to exponentially increasing numbers of UAS sales and their diverse capabilities, it is impossible for CASA to effectively regulate the UAS sector.

As Australia's civil aviation safety regulator CASA has no authority to allow economic or commercial considerations to influence safety-related decisions they are obliged to make. Only after all relevant safety-related factors have been considered with due precedence, can the economic or commercial considerations of that decision be taken into account. Where law allows a less onerous, but equally safe, alternative, CASA may certainly entertain that option. CASA's former Director of Aviation Safety, Mr John McCormick, stated: that "we have to address the current reality. There is no point in CASA writing regulations that can't be enforced. That's just bad law".[180] Consequently, CASA considered a weight limit of less than two

[178] The manufacturer was MultiWiiCopter who provided a submission to 'Eyes in the sky: Inquiry into drones and the regulation of air safety' The Parliament of the Commonwealth of Australia, Canberra, July 2014.
[179] With a vast proportion of UAS sales being online it is virtually impossible to attain accurate estimates.
[180] ABC, 'Rise of the drones raises privacy issues', *The 7:30 Report*, 8 September 2012 (Peter McCutcheon, Interview with John McCormick, Director of Aviation Safety CASA).

kilograms to make it less onerous for commercial operators to use small remotely piloted aircraft.[181]

The current CASR Part 101 deals with unmanned aircraft, model aircraft and rockets. As a result of the rapid growth and technological advancements in the UAS sector, this regulation has become somewhat ineffective and requires amendment. CASA plan to develop a new CASR Part 102, which will introduce the new terminology Remotely Pilot Aircraft (RPA), Remotely Pilot Aircraft Systems (RPAS), to bring the regulations more into line with the International Civil Aviation Organisation, and will incorporate the emerging work of other regulatory agencies such as the European Aviation Safety Agency (EASA) and the FAA.

The principal objective of the proposed updated regulatory framework is to achieve and maintain uniformity and the highest possible level of safety.[182] In the case of UAS, this means ensuring the safety of any other airspace user as well as the safety of persons and property on the ground. Identifying the commonalities and differences between manned and unmanned aircraft is the first step toward developing a regulatory framework that will provide, at a minimum, an equivalent level of safety for the integration of UAS into non-segregated airspace and at aerodromes. Technical specifications to support airworthiness, command and control data-link, detect and avoid technologies, and other functionalities are being addressed by various industry standards development organisations around the world. CASA will need to closely monitor these developments and remain focused on high-level performance-based standards.

Development of a complete regulatory framework for UAS is likely to be a costly and lengthy process. This should not be a knee-jerk reaction, but an evolutionary process, with regulations being developed and amended gradually. In the first instance, non-binding guidance and educative material should be provided in advance of the regulations for use by the industry. Close adherence to the ICAO *RPAS Manual* and other guidance material would facilitate later adoption of the revised or new regulations and would ensure harmonisation across the domestic UAS sector and with the rest of the world.

A major consideration for CASA is whether UAS operators should be provided different certification requirements within a given category of UAS, particularly for larger UAS that will be expected to meet requirements similar to general aviation aircraft. Currently, as stated above, CASA along with most National Aviation Authorities appear to be considering applications on a case-by-case basis[183] which is both costly and time consuming, and is more likely to lead to inconsistent outcomes and consequently make it difficult for UAS operators to have a clear picture of the requirements their UAS must meet before seeking approval.

While it may be argued that this practice is reasonable considering the fledgling nature of UAS regulation, it also presents the risk that if costs are uncertain or higher that the commercial cost of operations minus any penalties, UAS operators may not seek certification of their UAS and choose to operate the UAS without certification. This is undoubtedly what is happening at present without any real appreciation of the magnitude of the level on non-compliance.

[181] The current (2014) Part 101 NPRM had recommended that UAS weighing less that 2 kg and operated within the defined restrictions would not be required to attain an operator certificate. This move was strongly opposed by UAS industry associated and existing certified UAS operators.

[182] Based on the As Low As Reasonably Practical (ALARP) model.

[183] McCormick, J 'Development of UAS in Civil airspace and challenges for CASA' (Speech delivered at the Association for Unmanned Vehicle Systems Australia, Melbourne, 25 February 2013) < http://www.casa.gov.au/scri, Jim Coyne, 'CASA UAS Regulatory Developments' (Paper presented at the ICAO Regional Unmanned Aircraft System Seminar, Peru 18-20 April 2012) <http://www.icao.int/Meetings/UAS/Pages/UAS_Presentations.aspx>.

An option that could possible (although at best only partially) address this issue is to allow UAS operators to seek 'experimental' certification in lieu of the fully operational requirements.[184] While this may speed the development of UAS technologies, from the perspective of ensuring safety, authorities may consider the most ideal outcome is to proactively develop and impose standardised certification requirements that UAS must comply with in non-segregated airspace.

In considering the various alternatives in search of the most appropriate legislative approach to UAS regulation is whether other aspects of aviation regulation such as the introduction of safety management systems (SMS) and the move towards a more 'outcomes' based legislation are appropriate for UAS operators.[185] As previously stated the introduction of these measures is a result of the aviation industry moving beyond a prescriptive legislative model to a form of regulation that recognises that the safety of aircraft operations is affected by a wide range of factors such as the safety culture of operators, and that the aviation industry is mature enough for operators to choose how to meet safety requirements without limited oversight of an Authority.[186] It may be argued that while this approach is possible with a mature industry with a long history of safe operations, this approach may not be suited to new UAS operators, particularly those without operational or even *aviation* experience.[187]

On the other hand regulatory authorities could continue with a prescriptive legislative model until the industry has matured. This would reflect the reality that while widespread UAS operations might be new, the complex framework that is in place for safe operations in non-segregated airspace is the result of decades of experience which UAS operators may be unfamiliar with, and that the safety standards required today are far more important than in the early days of aviation when 'experimental' aircraft were common. A prescriptive legislative model may also assist in ensuring UAS operations are standardised at the outset, and reduce the likelihood of UAS operators developing individual practices with catastrophic results, a lesson that has been learnt well by existing operators.[188]

As a concluding comment to Part 2, irrespective of which path either CASA or other agencies adopt in regulating UAS activities the problem of effective oversight remains bewildering. The regulatory focus must remain on the safety of commercial air transport operations and of the fare-paying passenger. As some stage more attention must be directed toward promoting a greater role of the UAS sector itself and of reputable industry associations. Consideration of at least some degree of self-administered (as with other industry sectors)[189] may well be the outcome. It is important that self- administered is not confused with deregulation. CASA continue to provide safety oversight over bodies and organisations that have been granted various levels of delegated responsibilities. In the meantime the UAS industry continues to expand at exponential rates. The area of most growth – the small UAS operated by individuals in populous areas at low levels – remains mostly uncontrolled. In Part 3 it is argued, at least in Australia, that apart from being uncontrolled this industry sector may also be 'uncontrollable' under our current legal structure.

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[184] Hiltner, Philip 'The Drones are Coming: Use of Unmanned Aerial vehicles for Police Surveillance and Its Fourth Amendment Implications' (2013) 3 *Wake Forest Journal of Law and Policy*, pp 397 at p. 402.
[185] Bartsch, R *International Aviation Law* (Ashgate Publishing, 2012), p. 287.
[186] Bartsch, R *Aviation Law in Australia* (4th ed) op. cit. 77, 577 and 607-8; *International Aviation Law* Op. cit. p. 287.
[187] Bartsch, R *International Aviation Law* Op. cit. p. 26.
[188] A DC10 crash was the result of deviation from the usual process for removing the engine and pylon. Bartsch, Ronald, R *International Aviation Law* op. cit. p. 26.
[189] For instance, in Australia the Gliding Federation and the Parachute Association are both self-administrating bodies that provide for high safety standards and strict compliance to their operational standards and code of conduct.

3. THE CONTROL OF CIVIL AVIATION

3.1 The regulation of aviation activities

As was discussed in Part 2 in the aftermath of the two previous World Wars, allied governments were quick to respond to establish the agreed international arrangements necessary to control the rampaging technology and to enable aviation to continue to develop "for the benefit of all mankind".[190] Although the birth of the UAS era was a child of war its transition into civilian life had not gained the same attention and cooperative action of governments to the extent that was evident with both the Paris Convention of 1919[191] and the Chicago Convention in 1944.[192]

The international aviation industry is unique in that it has a far greater degree of universal harmonisation than does any other industry sector.[193] And because of the unbounded nature of aviation operations, ratification of international conventions is prolific and imposes strict obligations on contracting states. Governments are required to comply with highly prescriptive technical and operational standards to ensure the safety of international air transportation that apply not only to aircraft but also across the entire air transport system. However, because of the degree of interaction and interdependence between aircraft that share the same airspace, for aviation activities to remain safe, all aircraft must necessarily be subject to, and comply with, these internationally agreed standards.

International aviation standards are developed and promulgated by the International Civil Aviation Organization (ICAO). Nations that are signatures to the Chicago Convention 1944 – all 192 of them – are obliged to comply with the standards and recommended practices (SARPs) that are contained within the 19 ICAO Annexes in respect to international air transport. However, because of the mixing of both international and domestic flights, aircraft sharing the same airspace must necessarily 'commingle' with each other. Therefore, and perhaps somewhat by default, contracting states necessarily also apply ICAO SARPs to domestic air operations to ensure the safety of the entire air transport system.

Therefore *all* aircraft operations throughout the world, irrespective of their size, complexity or class of operation,[194] that share the same airspace as international air transport operations, are by (domestic) law, subject to the same aviation standards. Although the structure of domestic regulatory regimes vary considerably[195] the technical standards that are prescribed for all aircraft operations are essentially harmonised. This is the rationale for the application of what is referred to as the *commingling theory* that has been applied in respect to aviation regulation in a number of countries. It is not practicable, nor necessarily desirable, to attempt to explain the application of this theory throughout the world and such a task would be beyond the competence and

[190] The most important contribution of the Chicago Convention 1944 was the agreement over technical matters and the groundwork that led to the establishment of the International Civil Aviation Organization (ICAO). Article 44 of the Convention describes the purpose of the ICAO in the following terms: "To develop the principles and techniques of international air navigation and foster the planning and development of international air transport so as to insure the safe and orderly growth of international civil aviation throughout the world".

[191] This was the *Convention relating to the Regulation of Aerial Navigation* in Paris available for signature on 13 October 1919 and signed by all 27 states represented.

[192] This was the *Convention on Civil Aviation* in Chicago available for signature on 7 December 1944 and signed by all 52 states represented.

[193] See also: Milde M, *International Air Law and ICAO*, Eleven International Publishing, Montreal, Canada, 2008.

[194] An exception is 'state aircraft'. The Chicago Convention applies only to 'civil' aircraft and not to 'state' aircraft pursuant to Art 3(a)). Aircraft used in military, customs or police services are deemed to be state aircraft: Art 5(b).

[195] Although even domestic regulatory regimes are becoming increasingly harmonized and are usually aligned to either the European Aviation Safety Agency (EASA) or to the Federal Aviation Regulations (FARs) of the United States.

experience of the author.

In this paper the application of this commingling theory in respect to UAS operations will consider the United States experience – where the theory originated – but will focus upon Australia's legal system. Such an approach is reasonable, in consideration of Australia's prominent role in developing UAS certification standards and is testament and recognition of the Australian government's commitment to embracing the commercial benefits this technology affords. Before the commingling theory and its application in respect to UAS operations can be explained it is necessary to first consider Australia's somewhat unique legal structure and the limitations the Constitution imposes upon the Commonwealth (federal) Parliament to legislate in respect to aviation generally and UAS specifically.

As will be discussed in the following section the commingling theory has implications, and indeed limitations, over the extent to which the Australian federal government can legislate in respect to UAS operations. After all UAS are *still* aircraft and any constitutional limitations that apply to aircraft generally will also necessarily apply to UAS operations that operate in the same airspace. Also recall from previous discussion, any type or form of existing aircraft has the (increasing) capacity to be flown without a pilot on-board.

3.2 Regulation of aviation in Australia

In the aftermath of World War I, the potential threat to Australia and other nation states and their citizens of aircraft in hostile hands was well recognised. With the rapid increase in the development and prominence of civil aviation, governments were compelled to respond legislatively. The commercial impact and benefit to be derived from aviation was quite simply too important to be ignored – the safety and security risks too great to be unregulated.

Arising from discussions at the Paris Peace Conference in Versailles earlier in 1919, governments represented at this international air symposium discussed how post war civil aviation might be regulated. Agreement and co-operation amongst the allied nation representatives at the Paris Convention resulted in the Convention being signed by all delegates on 13 October 1919.

The preamble to the Convention included the words: "to encourage the peaceful intercourse of nations by means of aerial communications" and "to prevent controversy" which reflected the determination of the allied nations to agree upon consistent international legal regulation. Although initial dialogue on the topic had commenced at the Paris International Air Navigation Conference in 1910, delegates at that conference failed to reach any binding consensus. Nevertheless this earlier conference established the necessary groundwork (through dialogue and draft technical articles) for the 1919 Convention to become the first multilateral instrument of international law pertaining to air navigation.

Additionally, the Convention provided the basis, upon ratification, of enacting the first rules relating to aviation by many of the contracting states, including Australia. The following year and the year that saw the incorporation of QANTAS,[196] the Australian Commonwealth Parliament passed the *Air Navigation Act 1920* (Cth).[197] This statute authorised regulations to

[196] Papers formally establishing Queensland and Northern Territory Aerial Services Limited (QANTAS) were signed at the Gresham Hotel, Brisbane on 16 November 1920.
[197] Number 50 of 1920.

give effect to the Paris Convention.

This was the first legislation to apply to civil aviation in Australia and provided the regulatory framework for the industry for almost the next 75 years. Prior to this Act no Australian government, State or federal, had provided technical facilities or established administrative frameworks for the regulation of civil aviation. Therefore, up until this time, any professed pilot, irrespective of their qualifications, was at liberty to fly and carry passengers in any machine capable of taking off.

It was not until the passing of the *Civil Aviation Act 1988* (Cth) that the regulatory structure of aviation in Australia was significantly altered.[198] This is not to say that there were no legal problems associated with the regulation of civil aviation in Australia after the passing of this statute. On the contrary, because the Commonwealth Parliament is constitutionally limited in the making of laws specifically relating to aviation, co-operation with the States was, and still is, necessary to provide uniform aviation laws throughout Australia. The situation in Australia is well expressed in the following extract:

> The whole system of legal control of civil aviation in Australia is inescapably circumscribed by the federal Constitution. The historical condition that the Commonwealth of Australia had not experienced an aviation age at the time of its birth has exerted far-reaching influence on the development of the law. The lack of a specific power over the subject has put the Commonwealth in the position of having no express constitutional basis for generally intruding into intra-State aviation matters, and has brought about a dual system of Commonwealth and State law. On another view the system is triple – common law, State statutory law and Commonwealth statutory law are basic features of air law in Australia. Owing to the nature of the Commonwealth powers specifically enumerated in the Constitution, which are relevant, the scope of Commonwealth authority in respect of various subjects incidental to aviation has become extremely obscure and complicated.[199]

To complete the legislative process to achieve Australia's current national status as an independent and sovereign state it is important to briefly review the following statutes. As each of the colonies of Australia was still part of the British Empire in 1900 it required an Act of British (Imperial) Parliament to consent to them being "federated". This legislation was the *Commonwealth of Australia Constitution Act 1900* (Imp) and allowed for the passing of the *Commonwealth of Australia Constitution Act 1901* (Cth).[200] This statute is more commonly known as the Australian Constitution or simply the Constitution. It took effect from 1 January 1901.

3.2.1 The Australian Constitution

The Constitution establishes the legal framework for the nation and sets out how the power to make laws is distributed between the State and Federal Parliaments. The Constitution is probably the most relevant piece of legislation that exists in Australia today. Professor Leslie Zines, a prominent Australian constitutional lawyer, went as far as to state "few countries can be so dominated by a printed document as in Australia by its Constitution". And another point of view "few people can be so plagued with constitutional problems in their daily lives as are the

[198] Australia's regulatory framework has been significantly realigned by adopting the numbering of the Federal Aviation Regulations of the United States and harmonised, in terms of safety outcome-based style of legislation, with that of the European Aviation Safety Agency (EASA).
[199] Kuribayashi, T 'The Basic Structure of Australian Air Law' Masters thesis, Keio University, Tokyo, 1970, p. 433.
[200] The Constitution is a Schedule to this statute.

Australians." [201]

The limitations imposed upon the federal Parliament in respect to the regulation of civil aviation are a good example of how the Constitution can create difficulties and increase legal complexities within Australia. The State colonial governments required a guarantee, supposedly 'enshrined' within the Constitution, that they would retain certain powers upon federation. Any dispute requiring a determination of the meaning of any part of the Constitution would be heard before the High Court of Australia. The trend of the High Court has been to provide increasingly wider interpretations of the Constitution when determining the scope of the Commonwealth Parliament's legislative powers.

This approach by the High Court has had the effect of steadily eroding some of the State's traditional areas of responsibility. However, the difficulties of amending the Constitution to accommodate expansion of the federal government's authority have largely ensured the continued importance of the State governments. This was precisely the intent of the colonial architects of the Constitution.

While at times the Constitution is considered problematic, it is nevertheless an important document for the people of Australia. The Constitution has proved to be amazingly resilient with the passage of time and retains the ability to provide an effective and relevant system of government in the 21st century. But as to whether the constitutional status quo can accommodate the rapidly developing UAS technology remains to be seen and is a primary issue considered in this paper.

3.2.2 Amending and interpreting the Constitution

The Constitution, by way of construction, is purposely difficult to amend or repeal. Any change requires a referendum in which both a majority of voters nationwide and a majority of voters in a majority of the States must agree to the proposed changes. This is referred to as an "absolute" majority. Consequently, of the 44 proposed amendments since Federation, only eight have been adopted. Two of these defeated referendums have been specifically concerned with attempting to include the subject matter of aviation in the Constitution.[202]

The wording of the Constitution has caused ongoing dispute between the Commonwealth and State governments. Any dispute requiring a determination of the meaning of any part of the Constitution is heard before the High Court of Australia. While mostly concerned with appeals from lower (inferior) courts of both State and federal court systems (appellate jurisdiction), in matters concerning the interpretation of the Constitution the High Court hears the cases in their first instance (original jurisdiction).

The wording of the Constitution is necessarily ambiguous to provide a certain degree of flexibility when giving meaning to the words. This allows the Constitution to apply in instances that were not within the original contemplation of those who drafted the Act and sometimes with application in circumstances beyond the scope of the original intention. In other words, where appropriate the High Court can give a wide or broad meaning to the original words so that the Constitution can take into account current legal practice and social norms. For instance, the development of new technologies such as aircraft (including unmanned aircraft), television and

[201] Howard, C *Australia's Constitution,* Penguin, Melbourne, 1978, p. 11.
[202] Section 128 of the Constitution details the procedure for amending the Constitution.

the Internet all fall within the scope of the Commonwealth's powers under s 51 of the Constitution although none of these inventions are specifically stated in the Constitution.

Since the time of Federation the concept of nationhood has developed and the role played by the Commonwealth Parliament has increased. An important decision of the High Court of Australia in 1920 was the *Engineers' Case*[203], which established that where the interpretation of powers expressly conferred on the Commonwealth by the Constitution was concerned, they were to be given their widest, as opposed to their narrowest, reasonable construction. Since this case, the trend has been toward interpreting the Constitution in a manner that has resulted in a shift of power from the States to the Commonwealth. Even though this trend causes considerable concern for State governments, at the end of the day the Constitution means what the High Court says it means.[204]

3.2.3 Constitutional limitations in respect to aviation

The founders of the Commonwealth as we know it today could never have envisaged aviation. In fact the Constitution came into effect some three years before the Wright Brothers made their historic flight at Kitty Hawk. How then is the Federal Parliament able to legislate with respect to aviation in Australia? The answer lies with s 51 of the Constitution. There are five particularly relevant subsections (called placita) contained within s51. These heads of power relate to:

- international and interstate trade and commerce (pl. i);
- corporations power (pl. xx)
- external affairs (pl. xxix);
- acquisition of property (pl. xxxi);[205] and
- incidental power (pl. xxxix)

When interpreted widely these head of powers provide sufficient scope to allow Federal Parliament to legislate with respect to both interstate and international aviation. Accordingly the *Air Navigation Act 1920* (Cth) provided the first instance of legislative control of civil aviation in Australia. As is explained in the following paragraph this federal statute derived its constitutional authority from the "external affairs" power (s 51, pl. xxix) by ratifying the provisions of an international civil aviation treaty of which Australia is a signatory.

An international convention is the major source of international air law and is constituted by multilateral and bilateral agreements between sovereign states.[206] A convention does not become part of domestic law until and unless it has been incorporated into the law by legislation – in other words it has ratified.[207] The power to enter into conventions is part of the executive power

[203] *Amalgamated Society of Engineers v Adelaide Steamship Company Limited and Ors* (1920) 28 CLR 129.
[204] Lane, P *A Student's Manual of Australian Constitutional Law,* The Law Book Co, Sydney, 1972, p. 10.
[205] This head of power allows the Commonwealth to acquire land from the States for, inter alia, the construction of major airports. Since Federation, the Commonwealth has constructed 22 airports on State-acquired land. With the "privatisation" of these airports the Commonwealth has granted long-term leases to airport operators. In the United States, under similar constitutional powers, the Federal Aviation Administration has acquired land from the States for the purpose of UAS testing and research in six locations.
[206] In this paper, the term 'convention' is generally used to indicate such an agreement, whether it might ordinarily be identified by any of the terms 'convention', 'treaty', 'protocol' or 'agreement'. Where only a bilateral agreement is referred to the expression 'agreement' is used.
[207] *Ratify* means to confirm or adopt. For instance, the wording of the *Air Navigation Act 1920* (Cth) says, in effect, that the ratification of the Chicago Convention 1944 by Australia is *approved*. In effect the signing and ratifying of international treaties are executive acts – but in order to *honour* the international legal obligations, Parliament must enact the provisions of the treaty into the municipal law of Australia.

of the Commonwealth and is not within the competence of the Australian States. The Commonwealth may legislate to give effect to the provisions of conventions and the carrying out of obligations under them.[208]

As we shall see later in this paper in respect to certain aspects of aviation activities, namely those relating to technical and safety, the High Court of Australia, in considering the extent of the external affairs power, has broadly interpreted it to extend the Commonwealth's legislative powers to not only international and interstate aviation, but also to purely intrastate aviation activities so as to enable the Commonwealth to meet its obligations arising from the ratification of the Chicago Convention.[209]

Up until 1936 there had been no challenge of the validity of the Commonwealth to legislate with respect to civil aviation in Australia since the ratification of the Paris Convention of 1919. But what of intrastate aviation? Transportation within each State (intrastate) was considered to be the exclusive concern of State Parliaments. Then in 1934, Sydney-based pilot Goya Henry entered the scene.

R v Burgess; Ex parte Henry (1936) 55 CLR 608

> Goya Henry, a pilot from Sydney, was charged before a Court of Petty Sessions on information laid by an officer of the Civil Aviation Branch of the Department of Defence. He was convicted of flying without a licence in contravention of the Air Navigation Regulations 1947, his licence having been suspended two days earlier. All flights Henry flew while unlicensed were local flights including flying around, over and under the Sydney Harbour Bridge, none of which went beyond the boundaries of New South Wales. Upon conviction he appealed to the High Court. The Court held that the Commonwealth Parliament had no express power or general control over the subject matter of civil aviation but that the external affairs power did give Parliament power to ratify international treaties. The Commonwealth argued that its rules were made in pursuance of an international convention and were, therefore, laws with respect to external affairs. However, in this case, because the *Air Navigation Regulations 1947* were in conflict with the provisions of the Paris Convention, they were unconstitutional and therefore beyond the powers *(ultra vires)* of the Commonwealth. The provisions were hence invalid.

This was the first time the question of whether the aviation powers of the Commonwealth extended to legislating for the regulation of intrastate aviation. The question had been answered in the negative and hence proved to be an important test case. An important legal precedent had been established for the aviation industry.

During the trial, the only other head of power that seemed available to the Commonwealth was the 'trade and commerce' power under s51 (i), which states that trade, and commerce can occur 'with other countries and among the States'. There is, however, no direct power to regulate intrastate trade and commerce. Rather, for the Commonwealth to regulate an intrastate matter with s 51(i) it is necessary for that matter to be 'sufficiently connected' to inter-State or overseas trade or commerce. Neither 'necessity' nor economic interdependence of intrastate and interstate trade and commerce will provide a sufficient ground for the regulation of intrastate trade and commerce under s 51(i).

[208] See generally, Bartsch, Ronald I C (contributing author) 'Air Conventions and Administration' in *Halsbury's Laws of Australia*, Lexis Nexis, Sydney, 2015.
[209] *Airlines of New South Wales Pty Ltd v New South Wales (No 2)* (1965) 113 CLR 54.

The facts in *R v Burgess; ex parte Henry* were that Mr Henry had not been flying from or to any other State or country. The Commonwealth argued that the 'commingling' of intrastate aircraft with international and/or interstate aircraft on air routes and at airports enabled it to control all aircraft operations. That submission was summarily dismissed by the High Court.

> A new problem would be raised if in any given case it were established by evidence in respect of a particular subject matter that the intermingling of foreign and inter-State trade and commerce with intra-State trade and commerce was such that it was impossible for the Commonwealth Parliament to regulate the former without also directly regulating the latter. No such evidence, however, has been presented in this case, and it will be necessary to deal with such a question only when it is directly raised.[210]

The Court held that the Commonwealth could not restrain Mr Henry from flying around Sydney Harbour under the trade and commerce power. It was quite clear that the Constitution clearly distinguished between intrastate and interstate commerce, and confined the power of the Commonwealth to the latter.

3.2.4 Commingling theory

The so-called 'commingling theory' as it applies to aviation related litigation originated in the courts of the United States in the mid-1920s.[211] It has since then developed specifically in respect to aircraft-related litigations. At that time in the U.S. there had been challenges by the State governments in respect to the scope of authority of the federal government to make laws in respect to aircraft operations that were purely intrastate. The term in an aviation context was originally used to describe the situation in which aircraft from different points of departure (more accurately departures from different States) were flying in the same airspace – or 'commingling' with other aircraft. The relevance of the varying departure aerodromes was related to jurisdictional issues of the States and the varying regulations that applied to these flights.

As was described above, the commingling theory in Australia in respect to aviation, was first judicially considered (although not adopted) by the High Court of Australia in *R v Burgess.*[212] The Court explained the commingling theory initially in respect to its application in maritime situations. In the judgment the Court gave reasons as to why in 1936 in Australia the commingling theory could not be accepted:

> On several occasions the argument has been pressed upon this court that, where inter-State or foreign and intra-State maritime trade and commerce are so intermingled that it is practically essential to control all of them as one subject matter, the Commonwealth Parliament has power under s51 (i) and s98 of the Constitution to deal with intra-State navigation and shipping . . . Although foreign and inter-State trade and commerce may be closely associated with intra-State trade and commerce, the Court has uniformly held that the distinction drawn by the Constitution must be fully recognised, and that the power to deal with the former subject does not involve an incidental power to deal with the latter subject.[213]

The Court then went on to describe how the commingling theory *could* apply to the regulation of

[210] *R v Burgess; Ex parte Henry* (1936) 55 CLR.
[211] The first recorded case in which the commingling theory was raised was in *Colorado v United States* [1926] USSC 97: see http://caselaw.lp.findlaw.com/cgi-bin/getcase.pl?court=us&vol=234&invol=342
[212] *R v Burgess; Ex parte Henry* (1936) 55 CLR.
[213] Op. cit. p. 623.

aviation in Australia:

> If the rules, e.g., for landing upon an aerodrome, are not uniform, so that one pilot lands in a clockwise direction while another pilot, in the same place, obeying another set of rules, lands in an anti-clockwise direction, there is very grave risk of serious accident. Upon these and similar considerations the argument is based that in order to deal effectively with the subject of aircraft flying between the States or between Australia and other countries the Commonwealth Parliament must also have the power to deal with aircraft flying only within the limits of one State which use, as a matter of absolute necessity, the same air, and as a matter of practical necessity, the same aerodromes.[214]

Later in the judgment Evatt and McTiernan JJ gave reasons as to why the commingling theory could not be accepted:

> It is impossible to accept the theory of the Commonwealth that its power to legislate with respect to inter-State trade necessarily extends to all aircraft engaged solely in intra-State trade, by reason of the possible "commingling," in air routes and air ports, of the aircraft proceeding intra-State with the aircraft proceeding inter-State. No doubt, by virtue of sec. 109[215] of the Constitution, State laws or regulations of transport may be invalidated by valid Commonwealth laws or regulations dealing with the subject matter of transport. Moreover, the rejection of the "commingling" theory does not deny *that there may be occasions when parts of intra-State aviation will be seen to occupy so direct and proximate a relationship to inter-State aviation that the agents and instruments of the former will be drawn within the ambit of the Federal power, for otherwise the particular Commonwealth regulation of inter-State commerce would be entirely frustrated and nullified.* But this does not mean that the Commonwealth Parliament is legislating with respect to intra-State trade but only that legislation with respect to inter-State trade may operate in respect of or against persons, matters and things which, though not themselves directly involved in inter-State trade, are brought into a sufficiently proximate relationship with such trade.[216] (Emphasis added)

The emphasis above indicates that the High Court did foresee that at some time in the future the commingling theory might apply to the regulation of aviation in Australia. This was further supported in the judgment of the then Chief Justice:

> In respect of a particular subject-matter that the intermingling of foreign and inter-State trade and commerce with intra-State trade and commerce was such that it was impossible for the Commonwealth Parliament to regulate the former without also directly regulating the latter.[217]

The Court concluded that the express limitation of the subject matter of the power to commerce with other countries and among the States compels a distinction, however, artificial it may appear and whatever interdependence may be discovered between the branches into which the Constitution divides trade and commerce. This express limitation must be maintained no less steadily in determining what is incidental to the power than in defining its main purpose.

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[214] Op. cit. p. 645.
[215] Section of the Constitution provides: where a law of a State is inconsistent with a law of the Commonwealth, the later shall prevail, and the former shall, to the extent of the inconsistence, be invalid.
[216] Evatt and McTiernan JJ at 677. For a more detailed account on this topic see, Bartsch, Ronald I C (contributing author) 'Conventions Regulating Civil Aviation and Air Transport' in *Halsbury's Laws of Australia,* 2015, Lexis Nexis, Sydney, Australia.
[217] Op. cit. p. 629.

Following the *R v Burgess; Ex parte Henry* (also known as the first Henry Case), the *Air Navigation Act 1920* (Cth) was amended by omitting reference to the control of civil aviation generally throughout Australia, and was restricted to activities:

- in relation to trade and commerce with other countries and among the States; and
- with any Territory of the Commonwealth.

The above amendment was held to be valid in a further challenge by Goya Henry three years later in the *second Henry Case*.[218]

3.2.5 Referendums and legislation to gain greater federal control of aviation

To overcome the constitutional limitations identified in the *first Henry Case* the Commonwealth promptly decided upon a referendum and prepared the *Constitution Alteration (Aviation) Bill* (Cth) in 1936. This Bill provided for the insertion in s 51 of the Constitution (in placitum (vi)) the words: "Air Navigation and Aircraft". The proposed changes were put to the people in a referendum and were supported by a majority of voters, but remarkably failed to obtain majorities in four States.[219]

Following the failure of the referendum the Government convened an aviation conference of Commonwealth and State Ministers in April 1937. To provide uniform air navigation rules throughout the nation,[220] all States agreed to adopt the *Commonwealth Air Navigation Regulations 1937* as State law.[221]

After the passing of the uniform State *Air Navigation Acts* the Commonwealth powers, with respect to civil aviation, were limited to the licensing of personnel, airworthiness and registration of aircraft – in other words those aspects of aviation addressed in the Paris Convention 1919. It was not until almost 30 years later in Airlines *of New South Wales Pty Ltd v New South Wales (No 1)* (1964) 113 CLR 1 that the matter was again considered by the courts.[222]

3.2.6 Acceptance of commingling theory by the High Court of Australia

In *Airlines of NSW v New South Wales (No 1)* (Airlines of NSW Case (No 1), the High Court held that the States still had extensive powers in relation to civil aviation and that their legislation in fact still occupied much of the field.[223] But the Court sounded a clear warning to the future suggesting that the Commonwealth had power to move into much of the field then

[218] *R v Poole; Ex parte Henry* (1939) 61 CLR 634.
[219] Of all voters 53.6% agreed with the proposed amendments, however, a majority of votes came from Queensland and Victoria only.
[220] The expression "covering the field" is used where the Government statute, expressly or by implication, is the "whole" law on the subject.
[221] *Air Navigation Act 1938* (NSW); *Air Navigation Act 1937* (Qld); *Air Navigation Act 1937* (SA); *Air Navigation Act 1937* (Tas); *Air Navigation Act 1937* (Vic); and *Air Navigation Act 1937* (WA).
[222] There had been another (unsuccessful) attempt in 1944, by the then Labour Government, to amend the Constitution by inserting the words "air transport". This time only 46% of voters supported the referendum amendments. Then the Government attempted to nationalize interstate carriers (that is, airline operators) by enacting the *Australian National Airlines Act 1945* (Cth). However, in *Australian National Airways Pty Ltd v Commonwealth* (1945) 71 CLR 29 (the ANA Case) the High Court held that certain provisions of the Act purporting to give the Australian National Airlines Commission a monopoly in regard to the licensing of interstate carriers had contravened s 92 of the Constitution (that is, freedom of interstate trade and commerce).
[223] The expression "covering the field" is used where the Government statute, expressly or by implication, is the "whole" law on the subject.

occupied by the State Acts. The changes that had occurred in civil aviation in Australia since the Henry Cases were clearly significant and were duly recognised by the judiciary.

The Commonwealth government, in light of the judgment handed down in the *Airlines of NSW Case (No 1),* amended its *Air Navigation Regulations 1947* so as to apply to all classes of air navigation – international, interstate and intrastate. It also established a Commonwealth licensing system for intrastate air transport services. The validity of these far-reaching provisions was once again tested by the High Court in *Airlines of New South Wales Pty Ltd v New South Wales (No 2*) (1965) 113 CLR 54.

It was in this landmark aviation case that the High Court of Australia finally endorsed the commingling theory. The decision in this case represents the current legal position of the Commonwealth, however, constitutional limitations remain thereby restricting the scope to which the federal government can legislate in respect to civil aviation operations.

The Court in *Airlines of NSW Case (No 2)* held by a majority opinion that the Commonwealth no longer depended on constitutional authority ceded by the States to enforce air safety regulations on intrastate operations. Barwick CJ recognised the significant changes that had taken place in Australia's aviation industry since Goya Henry's historic flight in 1934:

> The speeds at which aircraft move in the air, the narrow, and narrowing, margins of time in which consequences of error or malfunction may be avoided or reduced, the increasing density of air traffic, the interdependence of safety of one aircraft upon the performance of other aircraft, the hazards of weather and the variable performance of aircraft, leading to diversion and re-routing of aircraft in flight, the need for use of common facilities . . . all combine to demonstrate that *all air operations irrespective of destination or of their particular nature must be subject to the same control if the air is to be safe.* (Emphasis added)

The scope of Commonwealth 'aviation' powers, with respect to purely intrastate services, does not extend to commercial aspects of aviation. It is clearly established in *Airlines of New South Wales (No 2)* that the Commonwealth has unlimited (de facto) power in Australian domestic aviation on any safety, operational or technical aspects of air navigation.

> This proposition so far as it is placed upon the power given by s. 51(i) is demonstrably insupportable. It is a claim that the Commonwealth has in some circumstances power to make laws with respect to some aspects of intra-State trade and commerce as themselves topics of legislative power. *But the Commonwealth has not and,* ***without constitutional amendment, cannot*** *obtain such legislative power with respect to any aspect of such trade and commerce, including intra-State commercial air transport as an aspect of intra-State air navigation.* No so-called "integration" of inter-State and intra-State air navigation or air transport, commercial or otherwise, no intermingling or commingling of the two to any degree, however "complete", can enlarge the subject matter of Commonwealth legislative power in the relevant field. It remains a power to make laws with respect to inter-State and foreign trade and commerce. This Court has never favoured, in relation to Commonwealth power, the more extensive view of the commerce power under the Constitution of Congress which has at times found expression in decisions of the Supreme Court of the United States.[224] (Emphasis added)

So some thirty years after Goya Henry's flight under the Sydney Harbour Bridge the High Court had no difficulty in upholding federal power to license *all* air navigation on the basis of *safety,*

[224] Ibid p. 78.

regularity and efficiency of the operations, including purely intrastate operations. One of the reasons relied on was that, whatever the situation in the 1930s, the safety of interstate and overseas air navigation in the 1960s could only be assured by the Commonwealth regulating the safety aspects of *all* air navigation in Australia. Acclaimed constitutional lawyer Professor Leslie Zines explains the significance of this judgment in respect to the regulation of aviation in Australia:

> A law therefore operating on purely intrastate carriage of goods and passengers by air was held to be a law with respect to trade and commerce with other countries and among the states. No doubt, if the Founding Fathers had been asked whether they could conceive of a situation where the power they had given the Commonwealth could be used to control an entire area of domestic trade and commerce within a state, they would have said 'No'. But that is because they were unaware of the hazards, speeds and complexity of modern forms of travel. It is probable that the framers certainly intended that the Commonwealth should be empowered to protect interstate and overseas trade. *What has changed since then are simply the facts of the world not the nature or object of the power.*[225] (Emphasis added)

Professor Zines' position relating to purely intrastate carriage is reflected in the judgment:

> The assumption of such an authority has no real relationship to the regulation of international and inter-State air operations and it is impossible to say that without the power to do this regulation by the Commonwealth of air navigation within the latter categories would be frustrated or nullified, or, for that matter, in any way adversely affected. That being so reg. 200B, [relating to State licensing requirements] in so far as it extends to intra-State air navigation, cannot be justified as a law with respect to trade and commerce with other countries and among the States. This, however, in no way denies the right of the Commonwealth under this head of power to establish rules to be observed generally and uniformly where, having regard to the safety and efficiency of overseas and inter-State air navigation, it is necessary to do so. [226]

Of significant interest to UAS operations Owen J in his judgment alluded to the extent to which the power of the Commonwealth may extend in respect to the regulation of aviation activities:

> I think the development of air navigation in Australia has reached a stage at which it can properly be said that in order to ensure the safety, regularity and efficiency of inter-state and overseas air navigation it is necessary that the Commonwealth should exercise a wide measure of control over intra-state air navigation. The question is, however, the extent to which that control may lawfully go. I have no doubt that it is within the power of the Commonwealth to insist that no intra-state air transport operations shall be conducted without its permission.[227]

3.2.7 The commingling theory as applied to UAS operations in the United States

In order to understand whether the commingling theory can be applied to UAS', the definition of the term "airspace" first needs to be defined in order to identify whether two aircraft, including unmanned aircraft, are in fact flying in the same "airspace" and therefore whether they are in a position to commingle'. In the United States, it appears that the FAA takes the view that the term "airspace" should be understood as all airspace over or appurtenant to the United States, which the administrator is empowered to "assign by regulation or order" for various enumerated

[225] http://www.aph.gov.au/About_Parliament/Senate/Research_and_Education. (Viewed 12 May 2014)
[226] Op. cit. p. 128.
[227] Op. cit. p. 167.

purposes.[228] "Airspace" is not defined in the U.S. regulations; however, Black's Law Dictionary provides the following definition:[229]

1. Space above property included in the properties title;
2. The space above any state that is under its jurisdiction.

The above definition seems to imply that all space above the ground is considered to be "airspace". However, to what extent does the FAA have jurisdiction over all the activities in the space above the ground? In the broadest meaning, the FAA would be empowered to regulate essentially any activity that occurs above ground. On this reasoning the FAA's definition of "aircraft" could be considered as 'overly broad', and literally speaking would give the FAA authority over balsa gliders and paper airplanes. However, such a meaning would be impractical. It is assumed that "the legislature did not intend an absurd or manifestly unjust result"[230] when enacting the statute.

The specific statute that deals with airspace in the United States is Title 49 of the U.S. Code sections 40103 although the term is not defined. Under USC §40103(a)(1) (Sovereignty and use of airspace) the federal government has exclusive sovereignty and use over domestic airspace. As a result, there is a significant limitation on the legal competency of state and local governments from promulgating laws, regulations or ordinances affecting access to the national airspace. There is, however, uncertainty as to whether state and local governments have powers to restrict or regulate the use of UAVs, including limitations on noise levels generated by these craft over any state.[231]

In 49 USC §40102(b), three powers are delegated to the administrator. They are as follows:[232]

- The administrator is empowered to "develop plans and policy for the use of the *navigable* airspace and assign by regulation or order the use of the airspace necessary";
- The administrator "shall prescribe air traffic regulations on the flight of aircraft (including regulations on safe altitudes)";
- The administrator is empowered to "establish security provisions that will encourage and allow maximum use of the *navigable* airspace". (Emphasis added)

All three powers above refer to "navigable airspace" which is above the altitudes typically used by small UAS in the United States, which is usually below 400 feet.[233]

3.2.8 Navigable airspace

Navigable airspace as prescribed by the Code of Federal Regulations 49 USC § 40102 is defined

[228] *Administrator v. Raphael Pirker*, NTSB Docket No CP-217, 2013.
[229] *Black's Law Dictionary* (9th ed. 2009).
[230] *Green v. Bock Laundry Machine Co.*, 490 U.S. 504 (1989). See also section15AA *Acts Interpretations Act* (Cth).
[231] Cho, George 'Unmanned Aerial Vehicles: Emerging Policy and Regulatory Issues' (2012-2013) 22 *Journal of Law, Information and Science* 201 at 2.1.3.
[232] §40102(b)(1); §40102(b)(2) and §40102(b)(3).
[233] The height of 500 feet (above ground level or AGL) is commonly prescribed throughout the world as the lowest height at which an aircraft (be it fixed wing, rotary or airship) can safety cruise. National Aviation Authorities (NAA) also designates certain areas for 'low flying'. The height of 400 feet AGL (and below) therefore provides a buffer (of at least 100 feet) from aircraft operating in navigable airspace. As to the basis of the rationale of a 100-foot buffer is unknown but presumably based on an arbitrary number being of sufficient height to ensure the safety of air navigation. This seems to be convenient convention that has been absorbed into the rarefied category of customary international air law.

as follows:

> *Navigable airspace* means airspace above the minimum altitudes of flight prescribed by regulations under this subpart and subpart III of this part, including airspace needed to ensure safety in the take-off and landing of aircraft.[234]

The question now posed is whether the FAA can regulate the flight of UAS if they are not operating in "navigable airspace"? There is no doubt that the FAA can prescribe air traffic regulations relating to the flight of aircraft provided it is for the following purposes:[235]

- Navigating, protecting and identifying aircraft;
- Protecting individuals and property on the ground;
- Using the navigable airspace efficiently; and
- Preventing collision between aircraft, between aircraft and land or water vehicles and between aircraft and airborne objects.

Therefore UAS or other 'systems'[236] that do not operate in "navigable airspace", whether such a system flies or is classified as an "aircraft" is irrelevant because the regulations are only concerned with systems operating in "navigable airspace". It is argued that the FAA seeks to regulate activities occurring in airspace without the distinction between navigable airspace and other kinds of airspace.[237] In short, the FAA is seeking to regulate activities outside their jurisdiction (*ultra vires*) that includes attempting to regulate UAS in certain instances. This raises several legal and constitutional questions.

An alternative point of view that has been put forward and that supports the proposition that the FAA has jurisdiction to regulate *all* airspace suggests that:

> The FAA's mandate [is] to regulate the use of *all* airspace necessary to 'ensure the safety' of aircraft, for 'protecting and identifying' those aircraft, and for 'protecting individuals on the ground' and is not confined solely to the navigable airspace'.[238] (Emphasis added)

In adopting this view of the airspace over which the FAA can regulate does not in any way, explicitly or implicitly, define the outer limits of such authority. In an attempt to resolve the issue the matter has been the subject of litigation and was considered in the case of *Huerta v Pirker.* Mr. Huerta is the FAA Administrator and represents the complainant – the FAA.

FAA v Pirker

> In October 2011 the University of Virginia commissioned Raphael Pirker, a Swiss UAS operator, to take a promotional video for the Universities medical school using his remote controlled aircraft.[239] In April 2012, the FAA sent Mr Pirker a letter detailed twelve instances of flying too close to buildings, people and streets. The FAA also pointed to the fact that Pirker did not have a pilot certificate and that he was operating the aircraft for

[234] Subtitle VII, Part A, Subpart i, Chapter 401.
[235] 49 USC §40103(b)(2).
[236] A 'system' for the purpose of this discussion appears to be any object or projectile that is capable of becoming airborne, that is, capable of operating in or occupying 'airspace' irrespective of the purpose or nature of such operation or occupation. For example, a rocket, a firework, a party balloon or even a bullet fired from a gun or an arrow fired from a bow may all be considered to be a 'system'..
[237] Straub, Jeremy, Vacek Joe & Nordlie, John 'Considering Regulation of Small Unmanned Aerial Systems in the United States' (2014) *Air & Space Law* 275, 281.
[238] Straub & Nordlie 'Considering Regulation of Small Unmanned Aerial Systems in the United States' (2014) *Air & Space Law* 275, 281.
[239] The UAS was a Ritewing Zephyr that is of foam construction and has a wingspan of approximately four feet.

compensation and assessed a fine of $10,000. On 27 June 2013 the FAA issued an administrator's order of assessment[240] imposing a $10,000 penalty against Pirker for operating a UAS in a "careless or reckless" manner.

In December 2013, Pirker filed a reply memorandum of law in further support of his motion to dismiss. Pirker contested the FAA's claims that the definition of aircraft in 14 C.F.R. § 1.1 is broad enough to include model aircraft[241] and that the FAA's jurisdiction extends to activity conducted in locations outside the navigable airspace. Pirker argued that "[t]he FAA's attempt to capture all activity in airspace everywhere elides the historic record concerning the creation of the public navigable airspace as it was carved out from the property rights of land owners decades ago . . . In the FAA's organic statute, Congress correspondingly empowered the FAA only to regulate activity in that same 'navigable airspace,' generally defined as the airspace at and above 500 feet." The FAA rejected this assertion relying upon the previously extracted mandate to regulate the use of all airspace necessary to ensure the safety of aircraft, for protecting and identifying those aircraft, and for protecting individuals on the ground – activities not confined solely to the "navigable airspace".

Mr Pirker appealed the FAA's determination to the National Transportation Safety Board Office of Administrative Law Judges (ALJ) on the basis that the FAA did not have regulatory authority over his actions. Pirker's two main arguments were first, that his UAS was not an aircraft for the purpose of the FAA regulations[242] and secondly, that his UAS had never entered the FAA's definition of navigable airspace (greater than 1000 feet above ground in this case) and thus was not subject to FAA regulation.[243]

On 6 March 2014 the NTSB Administrative Law Judge Patrick Geraghty ruled in favour of Pirker and dismisses the fine, citing that the FAA does not have the authority to regulate this aircraft in this airspace. The decision was based on the fact that Mr Pirker's foam airplane was considered to be a 'model aircraft' rather than an 'aircraft'.[244]

On 4 April 2014 the National Agricultural Aviation Association (NAAA) filed an *amicus curiae* (friend of the court) brief in support of the FAA. The case was of substantial interest to NAAA members given the safety hazards UAS may pose in low-level airspace used by agriculture pilots. In their submission the NAAA argued Pirker's aircraft was clearly operating within navigable airspace, which in their submission was defined as 500 feet AGL and above.

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[240] The order of assessment asserted that Pirker did not possess an FAA pilot certificate and operated the aircraft recklessly, including in a tunnel containing moving vehicles, under a crane, and unacceptably close to humans, buildings, and a heliport. The order of assessment alleged a violation of Section 91.13(a) of the *Federal Aviation Regulations*, which states: "no person may operate an aircraft in a careless or reckless manner so as to endanger the life or property of another".

[241] Cho, George, 'Unmanned Aerial Vehicles: Emerging Policy and Regulatory Issues' (2012-2013) 22 *Journal of Law, Information and Science* 201 at 2.1.3, The Academy of Model Aeronautics (AMAe), established by model aviation enthusiasts in 1936, has played an important role in setting up voluntary standards for the operation of model aircraft. The standards require flying model aircraft below 400 feet (122 m), flying model aircraft away from populated areas and segregated from larger aircraft. Different use and purpose distinguish model aircraft from UAVs. The FAA has used three categories based on mass to classify such vehicles — cruise missile, model aircraft, and unmanned spacecraft.

[242] Pirker alleged that that there were no existing federal aviation regulations governing the operation of model aircraft. He claims that the FAA expressly declined to regulate model airplanes, instead promulgating voluntary guidelines.

[243] Pirker's attorney, Mr Schulman, submission stated: "At a minimum, partial dismissal of the Complaint is warranted as to all [the FAA] allegations concerning operation at very low altitudes, inside a tunnel, below tree top level, or underneath a pedestrian overpass because these locations are not 'navigable airspace' subject to FAA jurisdiction".

[244] The rationale of the ALJ was that the FAA's definition of "aircraft" is overly broad, and strictly speaking would give the FAA authority over balsa gliders and paper airplanes. This obviously absurd example would lead a reasonable person would assume that the FAA's broad definition to be practically limited. Considering *Congress's 2012 FAA Modernization Re-authorization and Reform Act*, and *FAA Advisory Circular 91-57*, "model aircraft" have been considered as something different from "aircraft" when applying FAR 91.

> The FAA appealed to the full National Transportation Safety Board Office. In a unanimous decision handed down on 18 November 2014 the NTSB ruled in favour of the FAA. The NTSB found that UAS are 'aircraft' within the FAA's statutory and regulatory definitions and that they are prohibited from operation in a 'careless and reckless' manner. The NTSB defined an "aircraft" as "any 'device' used for flight in the air". The NTSB referred the case back to the ALJ with specific instructions to determine solely whether Mr Pirker's flight was "careless and reckless so as to endanger the life or property of another."

It is important to appreciate that the NTSB decision is strictly non-expert opinion and observation, and appears to be a very narrowly defined decision and does not address the issue of 'navigable airspace'. The composition of the NTSB is one of safety and regulatory specialists and not judges and who are primarily concerned with aviation safety rather than law or constitutionality.

Although the full National Transportation Safety Board Office were unanimous in their decision handed down on 18 November 2014 and overrides the decision of the ALJ on 6 March 2014 on the question of what constitutes an "aircraft" the latter decision leaves open the question of whether the FAA's authority extends beyond navigable airspace leaves the issue. A review of the earlier ALJ judgment and the submissions in that case therefore provides further guidance on the topic.

In the NTSB ALJ case Pirker contends that the FAA lacks authority to regulate beyond "navigable airspace". According to one prominent expert[245] in the area of legal issues associated with UAS operations in the United States Pirker attempts to "distinguish between navigable airspace (generally airspace above 500 feet, along with airspace necessary for landing and departure), on the one hand, and the airspace adjacent to land and buildings on the other. Pirker's claim is that only State common law and the airspace rights of property owners apply at these lower altitudes. The FAA counters that 49 U.S.C. § 40103(b)(2) gives the administrator the authority to prescribe regulations on the flight of aircraft for "navigating, protecting, and identifying aircraft" and "protecting individuals on the ground," and that the FAA's jurisdiction is not limited to "navigable" airspace but instead covers all airspace".[246]

In support of this later proposition Vacek (2014) suggests that adopting the former approach would "deny the FAA the ability to bring enforcement actions against UAS operators who harm individuals and property. It would thus effectively throw open the skies at altitudes below 500 feet to unregulated UAS operation, and potentially create a regulatory vacuum, which State and local authorities may try to occupy. This result could also potentially goad Congress into taking further action to regulate UAS specifically". While this case has the potential to offer further guidance on the FAA's authority over UAS operation, this case did not address related questions regarding whether the FAA is able to bring an enforcement action over a UAS operator flying in a safe manner.

In the above case the FAA has asserted that Pirker's operation was unsafe, and that the agency has the authority to regulate in the interest of safety, but the FAA's 2007 notice specifies that the current FAA policy for UAS operations contain no such limitation. Rather, it simply states that "no person may operate a UAS in the NAS without specific authority," regardless of the level of

[245] Joseph Vacek is Associate Professor of Aviation at the University of North Dakota School of Aerospace Sciences, Department of Aviation, where he teaches aviation and space law as well as technical aviation courses. His primary research area is in UAS law, including civil regulation and police use of UAS.

[246] Vacek, Joseph 'ALJ Decision May Usher In Legal Use of Commercial Drones' edited by Kenneth Hall, published 18 March 2014 at http://jurist.org/forum/2014/03/joseph-vacek-alj-drones.php (viewed 10 December 2014).

danger posed by the operation. If AC 91-57 and 2007 policy statement are indeed enforceable as written, then the FAA could bring an action against any operator of UAS who lacks specific authority — but this issue was not decided in *FAA v Pirker*.

Some insight as to the extent to which the FAA plans to enforce these rules, is provided by Mr Jim Williams, Manager of the Unmanned Aircraft Systems Integration Office of the FAA, when asked about the possibility of enforcement against a UAS operator:

> The bottom line is that unless you cross that line into hazardous or reckless behaviour or come to the attention of the FAA because you're operating a business illegally, the key is operating safely. And if you're operating safely and there's no obvious commerce going on, we're not going to get involved.[247]

While Pirker's motion only briefly addressed the "navigable airspace" issue, as previously stated above, the FAA responded by affirmatively alleging that it has the power to regulate all airspace in the U.S. not just that which is defined as navigable.

According to Vacek (2014) a series of Supreme Court decisions have roughly defined the boundaries on ownership of airspace is suggesting "property owners own as much airspace above their property as they can reasonably use,[248] and the air above is akin to a public highway that all persons have a right to transit. Additionally, zoning rules near airports defining approach and departure paths have been held as valid exercises of governmental police power. And while aeronautical charts used by pilots define certain categories of airspace—some of which start at the ground—and establish the operating rules within them, no court has squarely addressed the question of whether the FAA's designation and current claim of jurisdiction over all airspace in the U.S. goes beyond its statutory authority to regulate only "navigable airspace."[249]

Vacek goes on to explain that before small UAS were available on the market, the question was not ripe because relatively few activities used "non-navigable" airspace close to the ground. According to Vacek now it appears small UAS operated at those very low altitudes have become useful tools in many contexts: airborne photography, property surveying and agricultural uses, among others: "If the FAA stands on its assertion that it has the power to regulate all devices used or intended to be used in the air at all altitudes, it will collide with precedent defining property rights and what constitutes reasonable regulation of the use of that property".[250]

To address the issue of property rights one suggested regulatory approach in the U.S. is for UAS to operate at heights of no more than 400 feet AGL and at a height of not less than 200 feet above private property without the consent of the owner of that property.[251] But until the FAA promulgate legislation relating to the civilian usage of UAS the issue will remain unresolved."

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[247] Ibid.

[248] The same common law principle applies in Australia with the High Court of Australia having endorsed *Bernstein of Leigh (Baron) v Skyviews & General Ltd* [1978] 1 QB 479. While the common law and legislation clearly establish that no action will lie for a trespass during an overflight at normal, prudent cruising levels, there remains the possibility of a successful action for trespass succeeding against the operator of an aircraft – whether manned or unmanned - where overflight at low level intrudes upon the "ordinary use and enjoyment" of the land or its structures.

[249] Ibid.

[250] Ibid.

[251] Straub, Vacek & Nordlie, 'Considering Regulation of Small Unmanned Aerial Systems in the United States' (2014) *Air & Space Law* 275, 287.

Legal experts believe that at some point courts will need to address the constitutionality of these measures and of law enforcement's use of the technology. On this issue Texas-based attorney Gerry Morris, co-chair of the National Association of Criminal Defence Attorneys' Fourth Amendment Committee said: "I don't think the court opinions at this point have caught up with the technology. Legislators have to address the issue and get out in front of it".[252]

In concluding it is important to point out that the legal system and Constitution of the United States of America while similar to Australia's common law system and Constitution in many aspects has, nevertheless, many important differences. While aviation is generally regarded as the most internationally harmonised industry in terms of technical regulatory standards there are important differences in terms of implementation of these standards by contracting parties to the Chicago Convention. The following section considers the Australian position in respect to the degree of control over aviation activities by the Commonwealth Parliament and how this relates to the commingling theory.

3.2.9 Commingling theory as applied to UAS operations in Australia

In the above discussion, in respect to the United States, if the restricted interpretation of the definition of 'airspace' put forward by Mr Pirker had been accepted then the jurisdiction of the FAA might have been confined to 'navigable airspace'. If that had been the case the class of UAS (and other 'systems' as described in FN 234) that are 'not capable of' operating in navigable airspace would not have been within the FAA's authority to control such activities.

Unfortunately the issue of "navigable airspace" was not considered in the decision of the full National Transportation Safety Board Office in *FAA v Pirker* as it was not considered necessary to determine the issue. The NTSB found that the FAA had jurisdiction over any aircraft that may impinge upon or "endanger the life or property of another". In this case the safety issues over which the FAA has authority include: navigating, protecting and identifying aircraft; protecting individuals and property on the ground; and preventing collision between aircraft, between aircraft and land or water vehicles and between aircraft and airborne objects.[253]

It is the author's opinion that the situation in Australia in respect to the scope of authority of the safety regulator, that is the Civil Aviation Safety Authority (CASA), to regulate airspace is entirely different to that of the United States. This is due to our unique constitutional limitations (as previously discussed) that restrict the Commonwealth Parliament's scope of authority over the subject matter of aviation.

The question now turns to considering that particular class of UAS (and other 'systems' such as fireworks) that are *incapable* of flying into navigable airspace; either due to their inherent performance capabilities or through an internal system – electronic fences or G-gates – in the case of certain UAS. These UAS would *not be capable of* 'commingling' with other aircraft operating in navigable airspace. If it can be shown that CASA's authority is limited to regulating only in "navigable airspace" then the class of UAS (or other systems) that are "not capable of" operating in navigable airspace will not be within CASA's authority to control and hence any purported authority[254] to do so will be *ultra vires* and hence void.

Unlike in the United States the term "navigable airspace" is not defined in Australian civil

[252] Hudson, David L 'How should states regulate drones and aerial surveillance?' 1 February 2015, American Bar Association. http://www.abajournal.com/magazine/article (Viewed 2 February 2015)
[253] See Op. cit. and refer to 49 USC §4003(b)(2).
[254] For instance, *Civil Aviation Safety Regulations 1998* Part 101.

aviation law. Under the *Civil Aviation Act 1988* (Cth), "air route" is the only term that references "navigable airspace" in its definition. Under the Act the term is defined as: "the navigable airspace between two points and the terrain beneath such airspace identified, to the extent necessary, for application of flight rules".[255]

As previously stated Australia was the first nation to promulgate certification standards for the commercial use of drones or unmanned aircraft systems (UAS). The Australian Civil Aviation Safety Authority enacted "Part 101—Unmanned aircraft and rockets" in 2002. Relevantly the *Civil Aviation Safety Regulations 1998* subpart 101 in the 'Preliminary' section provides for the following:

> **101.005 Applicability of this Part**
>
> 1) This Part sets out the requirements for the operation of unmanned aircraft (including model aircraft), and (to the extent that the operation of rockets and fireworks affects or *may affect the safety of air navigation*) the operation of rockets and the use of certain fireworks.
> 2) Nothing in this Part applies to the operation of a manned balloon or a hot air balloon.
> 3) Subparts 101.C to 101.I do not apply to the operation of:
> a) a control- line model aircraft (that is, a model aircraft that is constrained to fly in a circle, and is controlled in attitude and altitude, by means of inextensible wires attached to a handle held by the person operating the model); or
> b) a model aircraft indoors; or
> c) an unmanned airship indoors; or
> d) a small balloon within 100 meters of a structure and not above the top of the structure; or
> e) an unmanned tethered balloon that remains below 400 feet above ground level; or
> f) a firework rocket *not capable of rising more than 400 feet above ground level*. (Emphasis added)
>
> Note: Subpart 101.B applies to the operation of all unmanned aircraft (including model aircraft) and rockets, including firework rockets.

Although, at the time of research, Part 101 is in the process of being revised and updated[256] there are some important points to be drawn from the above extract. In particular, in Part 101.005(1), in respect to the operations of rockets and fireworks, the regulations set out the requirements but limit their application "to the extent that the operation . . . *may affect the safety of air navigation*". It is submitted that for any system (UAV, rocket, firework or whatever) to "affect" the safety of air navigation then that system necessarily must be operating in the vicinity of, or in the same airspace in which aircraft are operating. In other words for any system to affect, or have the potential to affect, the safety of air navigation it must necessarily be able, or capable of, operating in navigable airspace.

As we have seen in the U.S. legislation, and a similar approach having been adopted in many countries, the term "navigable airspace" is used to describe the airspace at or above the minimum altitudes of flight prescribed by domestic civil aviation regulations or airspace needed to ensure safety in the take-off and landing of aircraft. In the absence of a statutory definition in Australia, it is suggested that this is precisely the meaning that was intended by the legislature,

[255] *Civil Aviation Act 1988* (Cth) s 3.
[256] CASA Part 101 NPRM.

where the term has been used in the regulations.[257] To adopt a significantly different interpretation of the term would lead to a divergence with international civil aviation standards – which is contrary to the objectives of the Chicago Convention and the ICAO and in breach of Australia's obligations as a contracting state.

Returning to subpart 101.005 it should be noted, at (3)(f), that subparts 101.C to 101.I do *not* apply to the operation of a firework rocket "not capable of rising more than 400 feet above ground level". It is strongly contended that the reason why Parliament decided to so limit the application of this sub-regulation was simply because it had no authority to regulate in instances where such activities were not capable of flying in or near (allowing for a 100 foot buffer) navigable airspace. In other words such activities of systems were not capable of *commingling* with other aircraft. The safety of air navigation was not affected and moreover was not *capable* of being so affected by such activities.

3.2.10 Systems not capable of entering navigable airspace

This paper argues that under current civil aviation laws of Australia any 'system' (as described in FN 234) that is not capable of entering navigable airspace is beyond the scope of Commonwealth authority. It is further suggested that the only ways in which a system may be restrained or restricted from entering into navigable airspace is limited to the following:

1. by virtue of its physical or aerodynamic capabilities: for example, fireworks with limited projectants or systems 'flying' only due to ground effect;[258]
2. in being physically restrained or tethered: for example, tethered balloons (as per CASR Pt. 101.005 (3)(e)) or a system operated 'indoors' (see CASR Pt. 101.005 (3)(b) and (c)) or within an enclosed structure, for example a stadium with an enclosed roof or ceiling (irrespective of the height of the structure); and
3. in being mechanically and/or electronically constrained: for instance in the case of 'geo-fencing'.

Geo-fencing is a feature in a software program that uses the global positioning system (GPS) or radio frequency identification (RFID) to define geographical boundaries.[259] This technology is already beginning to be utilised as a critical defence mechanism to control the use of UAS by limiting access to predetermined locations or altitudes. To date most of the geo-fencing has been aimed at restricting flight into certain predefined areas, such as within the vicinity of registered aerodromes or helipads. The technology has been directed more toward horizontal (geographic) restrictions rather than vertical (height or altitude) restrictions to create "no fly zones".

Application outside of aviation has long been realised, for example by marketers whom promote certain goods and services in defined geographic areas through the use of smartphone technology.[260] This location-based service sends "tailored" messages to the public based on whatever information that particular marketer knows about his/her target market.[261]

[257] This is consistent with the U.S. experience as previously discussed, however, because of statutory authority of the subject of aviation generally, Congress, and the hence its National Aviation Authority, can regulate in respect to certain systems even if they are not operating within "navigable airspace".
[258] The ICAO defines an aircraft as "any machine that can derive support in the atmosphere from the reaction of the air other than the reactions of air against the earth's surface" (Art. 7). See FN 113.
[259] See for example: http://www.cio.com/article/2383123/mobile/5-things-you-need-to-know-about-geofencing.html. Also see: http://www.techopedia.com/definition/14937/geofencing.
[260] See also http://www.bbc.com/news/magazine-30387107.
[261] See for example: http://mashable.com/2012/06/13/ios6-find-my-friends/.

Fencing technology, if required, can be used to provide limitations vertically in respect to UAS operations. According to Associate Professor K. C. Wong, School of Aerospace, University of Sydney, contemporary UAS autonomous altitude limiting technology has not been the focus of recent developments, but rather tending more toward pre-planned route algorithm.[262] Therefore, according to Wong the operator is able to manually trigger flight beyond any predetermined altitude. Wong concedes, however, that it is not difficult to develop robust systems that can provide altitude limits that utilise multiple sensors in addition to GPS for redundancy.

The Director of Queensland University of Technology's Australian Research Centre for Aerospace Automation (ARCAA), Professor Duncan Campbell, recently stated that "it was already possible to add GPS 'fences' which limit where a drone can fly and altitude limits to aircraft".[263] Therefore, according to the commingling theory, such types of UAS, if they are programed to operate at or below 400 feet AGL, would not be within CASA's regulatory control provided they were not operating in controlled airspace or in the vicinity of the approach or departure areas around an airport or heliport or presumably even an airfield or any other aircraft landing site.

The British Airline Pilots Association (BALPA) is currently campaigning for UAS manufacturers to utilise geo-fencing like the Phantom[264] series of UAS that includes geo-fencing. The GPS of the UAS is programed with the co-ordinates of thousands of airports around the world and cannot enter these areas. If the aircraft attempts to infringe these areas it will be forced to land. Moreover within a two-kilometre radius of a major airport its height is capped to only 10 metres AGL.

In the United States Senator Charles Schumer is planning to introduce a proposal that aims to make geo-fencing of UAS mandatory. On 19 August 2015 Senator Schumer announced he would propose an amendment as part of the Federal Aviation Administration Reauthorization Bill to require manufacturers to have in place geo-fencing technology "or other similar solutions" on all UAS so as to prevent them from flying in prohibited or restricted airspace.[265]

With all of the above three defined categories of restricting systems from commingling with aircraft operating in navigable airspace there is one important issue that needs to be considered. The phrase 'not capable of' in reference to systems rising to a height (generally regarded as beyond 400 feet above ground level) such that they affects or may affect the safety of air navigation requires clarification. In the absence of statutory definition (the phrase is not defined in CASR Pt. 101) the expression would require judicial interpretation in order to determine whether or not the 'restrictive' measures were sufficient to satisfy the requirement of 'not capable of' in the context of the legislation (as stated in CASR Pt. 101.005). No Australian judicial reference or discussion of this phrase within the context of aviation was identified.

As an illustration of the importance of clarifying the above expression consider the following example. In respect to a tethered balloon there must be consideration given to the strength of the tethering mechanism (for example its breaking strain) to ensure it is 'not capable of' rising above 400 feet AGL. Likewise in respect to UAS fitted with geo-fencing limiting devices consideration as to the integrity and robustness of the software and associated data linkage needs to be

[262] Correspondence Associate Professor K. C. Wong, School of Aerospace, University of Sydney, 4 February 2015.
[263] Prof Campbell, Duncan 'Drone Expert call for Federal Rules, Standards' *The Australian*, 13 February 2015, p. 30.
[264] The Phantom series of UAS are distributed by manufacturer DJI in the U.K. and are also operating in Australia. See: http://www.abc.net.au/news/2014-04-14/chinese-made-drones-programmed-with-no-fly-zones (viewed 6/8/15)
[265] http://faadaily.com/2015/08/20/us-senator-to-introduce-proposal-for-mandatory-drone-geofencing (viewed8/11/15)

assessed to determine whether or not they are 'capable of' so restricting the system's operations. Unless and until a precise definition (judicial or statutory) of the meaning of the phrase 'not capable of' is attained it is not possible to determine the extent to which these three categorisations apply.

Although it is beyond the scope of this paper it would be worthwhile to investigate whether or not the Commonwealth (under civil aviation law) has jurisdiction to regulate *any* aircraft (that is manned or unmanned) when operated within confined spaces. Does CASA have jurisdiction to regulate helicopter activities when operated inside, by way of example, Etihad Stadium in Melbourne, when the roof is closed? In consideration of the constitutional limitations discussed in this paper, and in applying the commingling theory, the answer may not be straightforward.

Based on the importance of the issue discussed above and the results of the research and findings contained within this paper it is recommended that consideration be given to studying the ramifications of the above statement. The outcome of such an inquiry may prove to be quite significant and may have far reaching implications in respect to the regulation of aviation activities in Australia and the safety of air navigation generally.

3.2.11 Restrictions upon aircraft operations under the Common Law

Even if the above argument concerning restricted operations is shown to be correct the operator of a UAS that is not capable of operating in navigable airspace may nevertheless still be subject to other cause of actions at both common law and under statute. Under the common law of Australia an action is trespass may succeed against the operator of an aircraft[266] that flies over a person's property at a height that may affect the owner's "ordinary use and enjoyment of his land and the structures upon it". This principle was established in *Bernstein of Leigh (Baron) v Skyviews & General Ltd*[267] and has subsequently been endorsed by the High Court of Australia and most other common law jurisdictions including the United States.

Alternatively, under the State *Air Navigation Acts*[268] there may be statutory provisions that may prohibit overflight in certain circumstances. The State statutes are rarely considered these days ever since the handing down of the High Court of Australia decision in *Airlines of NSW (No 2) Case*. As previously explained, this 1965 landmark decision of the High Court recognised that the Commonwealth no longer depended on constitutional authority ceded by the States to enforce air safety regulations on purely intrastate operations. However, if the operation of the type of UAS that are not capable of flying in navigable airspace is beyond the power of the Commonwealth then these statues may apply in certain instances[269] within the respective jurisdiction of each State.

In light of the issues raised in this paper the legality of the operation of unmanned aircraft systems that are not capable of operating in navigable airspace is likely to become a most contentious issue. This situation is augmented by the fact that this class of UAS will become even more *accessible, affordable, adaptable* and more capable of *anonymity*. This is the area of UAS regulation that needs to be addressed immediately otherwise the safety, rights, freedoms and privacy of individuals may be seriously compromised.

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[266] Or perhaps the remote pilot-in-command or both.
[267] *Bernstein of Leigh (Baron) v Skyviews & General Ltd* [1978] 1 QB 479.
[268] *Air Navigation Act 1938* (NSW); *Air Navigation Act 1937* (Qld); *Air Navigation Act 1937* (SA); *Air Navigation Act 1937* (Tas); *Air Navigation Act 1937* (Vic); and *Air Navigation Act 1937* (WA).
[269] Section 109 of the Constitution provides: where a law of a State is inconsistent with a law of the Commonwealth, the later shall prevail, and the former shall, to the extent of the inconsistence, be invalid.

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4. CONCLUSION

This paper contends that the adoption by contracting states of the ICAO guidance material contained in the RPAS Manual will significantly reduce both the time and cost associated with the UAS integration process from a regulatory perspective. Embracing an internationally coordinated implementation strategy will thereby allow for the potential benefits of this emerging technology to be more quickly realised while at the same time ensuring society is protected from its harmful risks – at least from a safety perspective.

Irrespective of how individual states attempt to integrate UAS operations domestically, ultimately, if the international applications of UAS operations are to be fully realised, governments will be compelled legally to comply with their international obligations arising under treaties and in particular the Chicago Convention 1944. Apart from identifying the scope and diversity of the legal issues deriving from the development of UAS standards, this paper also identified some unique yet fundamental legal challenges in Australia.

The Parliament of the Commonwealth of Australia has long since recognised the critical and forever increasing importance of aviation to its people and the economy. The federal government of the day has – through legislation and referendum – sought to gain greater control over aviation but with limited success. The High Court of Australia has, for the past five decades since the *Airlines of NSW (No 2) Case*, remained steadfast in its position regarding the constitutional limitations that prevail. This case remains the high water mark in defining the limits to which the Parliament can control aviation. And the States and their constituents have likewise resisted attempts by the Commonwealth to gain greater control over the subject.

Since the introduction of powered flight aviation has changed enormously and developed at an unimaginable speed. But never before, even since the advent of the aeroplane, has the rate of technological advancement and diversity of application of aircraft design been so momentous, as has been the case with unmanned aircraft. And yet the Constitution has essentially remained static during this time. The Constitution *is* what it *is* and not what the Parliament wants it to be. And the Constitution *means* what the High Court says it *means* and not what the Parliament wants it to mean. What has changed is the world in which we live and not the Constitution.

With the unmanned aircraft era decisively upon us this industry sector now poses novel and unique challenges to society, particularly in the area of privacy and security. This research has shown that unlike any previous form of aircraft design, UAS can operate – with unbounded agility – in regions that were not previously accessible to their manned counterpart. It is contended that the particular class of UAS that, by design or purpose, are *incapable* of flying in navigable airspace, are not within the ambit of current UAS regulatory control. The fact that these aircraft are therefore incapable of commingling with manned aircraft means that constitutionally the Commonwealth Parliament has no authority to regulate them.

In the past the State Governments have agreed, through legislative processes, to supplement those areas where the Commonwealth lacks authority, and thereby ensure that the full control over aviation activities and thereby benefiting society as a whole. But with the rate of development of UAS technology it is highly unlikely that the States will be able to collectively and unanimously – as is required with ‘mirror’ legislation – agree upon such measures without subjecting society to intrusions of privacy and possibly unacceptable safety risks. Has the time finally arrived – after 70 years – that the question of constitutional reform should

to be revisited?

The problem of constitutional limitations over the subject of aviation has plagued successive federal parliaments for almost a century – almost since the time of the first civil aviation law. But now this new breed of unmanned aircraft threatens to encroach upon the freedoms and privacy of everyday Australians. Whereas in the past, with the advancement of aircraft design and performance – and with it increasingly over-crowded skies – a balance had to be struck between the benefits the technology bestows upon the economy to the degradation of an individual's freedom and enjoyment of life. The impact of the operations of large commercial airliners upon the environment in terms of noise and pollutants emissions is well known.

With the particular class of small UAS, that this paper argues are beyond the Commonwealth's regulatory control, there are aspects of these operations – notably invasion of privacy and security threats – which do not confer any accompanying commercial benefit to society. It is suggested that this is something that the voting population of Australia would surely concur and agree to expand the scope of the Commonwealth's power. By simply adding the single word "aviation" to the section 51 of the Constitution by way of referendum the Commonwealth's power would cover the field.

As a concluding comment the purpose of this research is in no way to stifle or impede the development and uptake of this technology within civil aviation – not that that would be either possible or desirable. As a new form of aircraft UAS, as with for example the introduction of the helicopter, can provide enormous benefits for the aviation industry and indeed the wider community. The task ahead for regulators and governments is articulately described below:

> It is vital that when achieving the milestone of the twenty-first century, RPASs are integrated into the non-segregated airspace without reducing existing capacity but maintaining safety levels currently imposed and minimizing potential dangers to other aircraft, passengers, and other persons and property on the ground. A further challenge faced by the aviation authorities internationally in relation to the upcoming full integration of RPASs is to deal not only with the vast legal ramification but also with the societal and ethical implications thereof. Whether this will be done through amendments of existing legislation or the enactment of a new international Convention dealing specifically with UAS remains to be seen. What is, however, clear is that this great technological advancement of aircraft is the future of aviation and that RPASs will inevitably reshape the conventional use of airspace as we now know it.[270]

It is hoped that this research may assist in providing a wakeup call for governments throughout the world to more aggressively engage in collective and harmonised dialogue to develop effective implementation and integration strategies for civilian UAS operations. Without exception this has been the situation with all previous rapid advancements in aircraft design and technology of this magnitude – indeed they have been the basis for international conventions – most notably the *Paris Convention 1919* and the Chicago *Convention 1944.*

The potential impact of civilian UAS operations, perhaps by virtue of their inherent design, seemed to have thus far, slipped under the radar. This paper suggests that what is required to address the emerging UAS issues is a 'whole of government approach' in respect to

[270] Michaelides-Mateou, S & Erotokritou, C 'Flying into the Future with UAVs: The Jetstream 31 Flight' at p. 129.

implementation strategies and due to the unique characteristics of aircraft operations, this needs to be initiated, coordinated and promulgated at the international level.

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