

THE REGULATORY FRAMEWORK FOR AERIAL IMAGING BY RECREATIONAL USERS OF “DRONES” IN SINGAPORE

Old and Emerging Issues and Some Possible Solutions

In response to the sudden proliferation of hobbyist unmanned aerial vehicles used for digital imaging – or “drones”, as they are popularly, but rather inaccurately, labelled – the Singapore government enacted the Unmanned Aircraft (Public Safety and Security) Act in 2015 and also amended various existing laws relating to air navigation. However, in view of the rapid evolution in drone technology and the ever-expanding range of useful applications brought about by drones, what are some of the challenges that would be faced when enforcing the law against recreational users of aerial imaging in particular, and what are some of the changes that should be made to the law when the matter is revisited for review in the future? Through an appraisal of the current state of drone technology and a comparison with the rules that have been adopted in various other jurisdictions around the world, this article considers how our existing laws on recreational users of drones can be improved, and also highlights emerging issues that would eventually warrant regulatory attention here and elsewhere. The matters to be discussed here include whether limits should be placed on distance, speed, and people proximity, whether drones truly pose a threat to privacy and other related rights, and how drone safety can be enhanced independently of a permits and permissions system.

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I. Background and roadmap

1 Unmanned aerial vehicles, or remotely piloted aircraft, are by no measure completely new technologies, but one particular iteration of them – ready-to-fly multi-rotor copters equipped with digital technology for aerial imaging, and also often given the misleading appellation of “drones” – can only be said to have become mainstream

and affordable in the last couple of years.¹ Because of this development, any member of the public is now able to easily purchase and pilot something that has had a longstanding association with military surveillance and warfare, and recreational and professional users alike have been engaging in aerial imaging on this new platform on an unprecedented scale.² In the case of the recreational user, regulation is complicated by the fact that because of ease of use and the nature of the hobby, drone imaging is inherently a solo activity that often leaves no traces – a typical user takes no longer than half an hour to set up, fly, take the images, and leave. Should there be any incident that requires investigation, it may be difficult to establish the facts, as even witnesses may not know who was piloting the drone.³ Moreover, unlike commercial operators who have an incentive not to be decertified by the authorities of their exploitative rights and are accountable to their clients, and social flying clubs which are likely to insist on safe flying practices within their ranks, the average drone user operates under no such constraints.⁴ Drone imaging offers spectacular possibilities, and with the allure of capturing a photograph that would go “viral” on social media, some drone users may be tempted to push the envelope as to what is considered safe and responsible. An overly oppressive regulatory framework may not necessarily result in compliance in the long run, even in Singapore.

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- 1 *The Economist*, “Suddenly, There are Drones Everywhere” <<http://www.economist.com/news/science-and-technology/21684685-and-pilots-are-reporting-ever-more-close-encounters-them-suddenly-there-are>> (accessed 5 December 2016). At the outset an important disclosure ought to be made: the author is part of a group of co-owners of a DJI Inspire 1 Pro (specifications of which will be explained later in the article) who are regular contributors to a Facebook page related to drone photography and videography in Singapore. However, while the group obviously have some vested interest in advocating greater navigational freedom for aerial imaging, they are mindful of the need to constantly evaluate the right balance between public safety, advancement of technology and individual rights. Moreover, adopting an overly permissive regulatory framework would not be in anybody’s interests either, as the slightest negative incident is likely to be attributed to lax laws and the inexorable result can only be over-regulation that might take a very long time to reverse. Being actual and active users of the technology, the group have a particular vantage point when analysing the limitations and vulnerabilities of the hardware and, concomitantly, the gaps and questionable assumptions in the law.
 - 2 See generally *Singapore Parliamentary Debates, Official Report* (11 May 2015) vol 93.
 - 3 Relatedly, there was a recent report of a remote-controlled aeroplane that damaged the roof of a block of flats, but the operator was never located: Valerie Koh, “High Time for Laws to Catch Up on Drones: Experts” *Today* (16 October 2016).
 - 4 Henry Perritt & Albert Plawinski, “Making Civilian Drones Safe: Performance Standards, Self-Certification, and Post-Sale Data Collection” (2016) 14(1) *Northwestern Journal of Technology and Intellectual Property* 1 at 32.

2 Countries all over the world have since struggled to find a timely, precise and proportionate response in attempting to regulate the phenomenon of widespread recreational drone usage, mainly because there remains a prevalent – but eminently questionable – assumption that drones are either inherently unstable or likely to fall into the hands of criminals, and the drones can therefore cause great damage to property and people, if not violate privacy and other related rights.⁵ Widely reported stories of supposed drone “incidents” – be it drones being flown near airports,⁶ being flown near restricted government infrastructure,⁷ interfering with emergency responders,⁸ delivering drugs to criminals,⁹ crashing into unsuspecting crowds in high-profile events,¹⁰ being destroyed by vigilante home-owners,¹¹ being used to mount weapons¹² or being targeted for use by terrorist groups¹³ – have not helped with improving public opinion either. Drones simply have a very bad reputation by virtue of the negative press they regularly receive, and the tide does not look like it would turn any time soon.¹⁴ The benefits of drone technology, be it for the provision of vital public services,¹⁵ the innovative improvement of commerce¹⁶ or the radical

5 See generally Chen Siyuan, “The Regulation of the Recreational Use of ‘Drones’ for Aerial Photography and Videography: Comparing Singapore’s Unmanned Aircraft Act with Other Legislation” (2015) 33 *Sing L Rev* 55.

6 In one infamous incident, what was reported to be a close shave with a drone turned out to be a close shave with a plastic bag: Steven Swinford, “Drone Believed to Have Hit British Airways Flight ‘May Have Been a Plastic Bag’” *The Telegraph* (21 April 2016).

7 See for instance Bart Jansen, “Small Drone Crashes Near White House Despite Ban Against Flights in DC” *USA Today* (9 October 2015).

8 See for instance Dave Lee, “Drone Industry Delight at New US Rules” *BBC News* (22 June 2016).

9 See for instance Jack Nicas, “Criminals, Terrorists Find Uses for Drones, Raising Concerns” *The Wall Street Journal* (28 January 2015).

10 See for instance Kevin Rawlinson, “Man Comes Forward After Woman Knocked Out by Drone” *BBC News* (1 July 2015).

11 See for instance Michael Archambault, “Man Wins Lawsuit Against Neighbour Who Shot Down Drone with Shotgun” *Peta Pixel* (29 June 2015).

12 See for instance Alex Lockie, “An 18-year-old Mounted a Gun to a Drone and Fired Shots in the Middle of the Woods” *Business Insider* (22 July 2015).

13 See for instance Ian Johnston, “Terrorists Could Use Drone Bombs to Attack Nuclear Power Stations, Experts Warn” *Independent* (11 January 2016).

14 Even professional operators, who are supposed to possess the relevant competence and certifications, have had their share of high-profile accidents: see for instance James Billington, “Deadly Drone Accident Dodged by World Champion Skier Marcel Hirscher during Downhill Slalom” *International Business Times* (23 December 2016) and James Lillywhite, “Huge Drone Crashes over London Crowd during Muse Gig at the O2” *International Business Times* (15 April 2016).

15 See for instance Lester Hio, “Govt Agencies Testing More Than 25 Potential Uses of Drones” *The Straits Times* (5 February 2016).

16 See for instance Guillaume Thibault & Georges Aoude, “Companies are Turning Drones into a Competitive Advantage” *Harvard Business Review* (29 June 2016).

transformation of the media and entertainment industries,¹⁷ are simply not as newsworthy (and therefore as well known) in comparison.

3 In Singapore, the Government was quite quick to respond legislatively to what it perceived as a growing problem when the recreational use of drones – particularly those equipped with digital imaging capabilities – became visibly popular in around 2014.¹⁸ Indeed, the parliamentary debates surrounding the enactment of the Unmanned Aircraft (Public Safety and Security) Act¹⁹ in 2015 were also telling in terms of the Government’s characterisation of the potential issues. Although the Minister for Transport who had introduced the Bill to the Legislature was quite circumspect in his views in that drone technology required a “balanced and sustainable regulatory framework” so as not to impede innovation and responsible recreational use, the other Members of Parliament who spoke appeared to be much more skeptical.²⁰ The great concern for possible invasions of privacy was almost unanimous, while a couple of Members of Parliament even suggested increasing police powers so that the authorities could not only commandeer drones from “rogue” users, but also be equipped with the weapons to destroy the drones either upon landing or while they were still in the air.²¹ In the end, while rationality prevailed and the more extreme suggestions raised during the debates were not adopted, the debates also did nothing to alter the original contents of the Bill, and the Air Navigation Act²² (and its subsidiary legislation in the form of the Air Navigation Order)²³ and Public Order Act²⁴ were amended accordingly.²⁵

4 This article has two primary aims. First, it seeks to identify some of the critical gaps in the current regulatory framework for recreational drone users – gaps which should have been identified, extensively discussed with the benefit of input from proper experts, and pre-empted even before the new law was passed. The identification of the gaps in the framework is done in the light of how drone technology, particularly with respect to aerial imaging, has evolved greatly and is likely to evolve even more, and also by surveying the wide variety of

17 See for instance Sally Newall, “How Drones are Transforming TV Production” *Independent* (27 February 2016).

18 See Ronald Wong, “Legal Regulation of Drones or Unmanned Aerial Vehicles in Singapore” *Singapore Law Gazette* (September 2015).

19 Act 16 of 2015.

20 *Singapore Parliamentary Debates, Official Report* (11 May 2015) vol 93.

21 *Singapore Parliamentary Debates, Official Report* (11 May 2015) vol 93.

22 Cap 6, 2014 Rev Ed.

23 Cap 6, O 2, 1990 Rev Ed.

24 Cap 257A, 2012 Rev Ed.

25 The Unmanned Aircraft (Public Safety and Security) Act 2015 (Act 16 of 2015) itself only contains references to the amended provisions in these two statutes and does not create any new law.

approaches taken by other jurisdictions in regulating the use of drones. Secondly, given the Government's promise to continue to closely monitor development in this area of the law,²⁶ this article advocates for a more proportionate and rational response from the Government and other stakeholders should future opportunities to amend the regulatory framework arise, and further highlights some of the emerging issues that would eventually warrant close regulatory attention.

5 To this end, this article is divided into the following main parts: Part I,²⁷ as we have just seen, briefly sets out the context and the aims of this article; Part II²⁸ attempts to navigate the current web of laws and subsidiary legislation in Singapore to provide as complete a picture as possible of the state of regulation for drones (whether used for aerial imaging or otherwise); Part III²⁹ then highlights some of the key problems that have either eluded meaningful legislative responses or are likely to emerge as important issues in the near future, and proposes some possible solutions; and Part IV³⁰ is where the recapitulation and concluding thoughts reside. Where appropriate, the practices and regulations of other jurisdictions will be highlighted and considered along the way.

II. Current regulatory framework in Singapore

6 What exactly, then, is the current regulatory framework for the use of drones in Singapore? It is not that easy to discern immediately, as the regulations are scattered throughout various sources of law rather than consolidated in a single piece of legislation. Previously, there was no direct regulatory framework for the use of modern consumer drones; instead, there was a piece of subsidiary legislation (the aforementioned Air Navigation Order), introduced several decades before, that regulated the use of model aircraft and other similar aerial objects.³¹ However, because model aircraft are fundamentally different from drones in terms of characteristics and functions, a series of guidelines was issued by the

26 *Singapore Parliamentary Debates, Official Report* (11 May 2015) vol 93. The Minister for Transport had admitted that the Bill was being expedited through Parliament as the Southeast-Asian Games and National Day Parade were round the corner.

27 See paras 1–5 above.

28 See paras 6–10 below.

29 See paras 11–36 below.

30 See paras 37–39 below.

31 See generally Chen Siyuan, "The Regulation of the Recreational Use of 'Drones' for Aerial Photography and Videography: Comparing Singapore's Unmanned Aircraft Act with Other Legislation" (2015) 33 *Sing L Rev* 55.

Civil Aviation Authority of Singapore (“CAAS”) to fill in the gap while the Government deliberated on the appropriate legislative response.³²

7 That response materialised in 2015. Following the enactment of the Unmanned Aerial (Public Safety and Security) Act, amendments were made to the Air Navigation Act, Air Navigation Order and Public Order Act. Reading all four pieces of legislation together, unmanned aircraft – which we can safely assume to refer primarily to drones – that are being flown within Singapore, whether for aerial imaging or otherwise, are not permitted to do the following:

(a) Fly at an altitude above 200ft above mean sea level unless a permit from CAAS (from which all drone permits and certifications are obtained) has been obtained; if this is contravened, the punishment upon conviction is a fine not exceeding \$10,000 (not exceeding \$20,000 for subsequent convictions).³³ However, it is unclear if this prohibition still applies if the drone is flown over portions of the sea that go beyond Singapore’s territorial waters (but took off from within the territory of Singapore).

(b) Fly within 5km of an airport or airbase unless a permit has been obtained;³⁴ if this is contravened, the punishment upon conviction is a fine not exceeding \$10,000 (not exceeding \$20,000 for subsequent convictions).³⁵ To be clear, the actual term used in the legislation is “aerodrome”, which is defined as “a defined area on land (including any building, installation and equipment) used or intended to be used, either wholly or in part, for the arrival, departure and surface movement of aircraft”. This conceivably includes landing pads for helicopters as well, since “aircraft” is broadly defined as “any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth’s surface”. However, CAAS itself appears to equate aerodrome only with airports and airbases.³⁶

(c) Fly within danger, prohibited or restricted areas;³⁷ if this is contravened, the punishment upon conviction for flying

32 See generally Chen Siyuan, “The Regulation of the Recreational Use of ‘Drones’ for Aerial Photography and Videography: Comparing Singapore’s Unmanned Aircraft Act with Other Legislation” (2015) 33 Sing L Rev 55.

33 See Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) paras 72D and 80(4).

34 See Annex 1 below.

35 Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) paras 72D and 80(4).

36 Civil Aviation Authority of Singapore, “Area Limits” <<http://www.caas.gov.sg/caas/en/ANS/area-limits.html>> (accessed 5 December 2016).

37 See Annex 2 below. Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) paras 72D and 72E. A “danger area” is defined as an airspace which is declared by the Chief

(cont’d on the next page)

inside danger or restricted areas is a fine not exceeding \$10,000 (not exceeding \$20,000 for subsequent convictions),³⁸ while the punishment upon conviction for flying inside prohibited areas is a fine not exceeding \$20,000 (not exceeding \$40,000 or imprisonment not exceeding 15 months, or both, for subsequent convictions).³⁹ It appears that no permit may be obtained to fly within danger, prohibited or restricted areas.

(d) Fly within or over protected areas (and no photographs or videos may be taken of those security-sensitive areas during such flights) unless a permit has been obtained; if this is contravened, the punishment upon conviction is a fine not exceeding \$20,000 or an imprisonment term not exceeding 12 months, or both.⁴⁰ However, the defence of weather conditions (such as wind drifts) or unavoidable cause may be raised.⁴¹ Notably, this defence is not available to the offences listed in the three preceding paragraphs, *viz*, flying above the height limit, flying within 5km of aerodromes, and flying within danger, prohibited or restricted areas.

(e) Fly in a way that is likely to endanger the safety of any person, aircraft or property; if this is contravened, the

Executive of the Civil Aviation Authority of Singapore (“CAAS”) as an area within which activities dangerous to the flight of aircraft may exist at specified times; a “prohibited area” is defined as an airspace declared by the Chief Executive of CAAS as an area within which the flight of aircraft is prohibited; and a “restricted area” is defined as an airspace declared by the Chief Executive of CAAS as an area within which the flight of aircraft is restricted. On the face of it, none of these definitions are helpful at all even if the idea was to preserve flexibility for the authorities as they contain no obvious distinctions.

38 Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) para 80(4).

39 Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) para 80(5).

40 Air Navigation Act (Cap 6, 2014 Rev Ed) ss 7 and 7A. A “protected area” is defined by what the Minister has by order published in the *Gazette* (which does not appear to have a search function, and does not contain past notices). Further, according to the Civil Aviation Authority of Singapore, the drone may not be flown within 150m of the protected area as the restriction is not limited to overhead flights. The same problem, however, rears its head: are there any obvious differences between danger, prohibited, restricted and protected areas? While one may consult the useful web portal <onemap.sg> for a visual on where these areas are (for which the annexes to this article are based on), there are at least four shortcomings. First, only danger, prohibited and restricted areas are shown, but not protected areas. Secondly, one suspects that the map is overinclusive – for instance, it is difficult to see how an entire chunk in the Civic District is cordoned off. Thirdly, even though <onemap.sg> (or the Civil Aviation Authority of Singapore’s online maps) is sanctioned by the Government, it is unclear if a user can rely on its information as a matter of law, or whether a user can point to some other source of information when a dispute arises. Finally, there is no guarantee that the information is constantly being updated in accordance with the latest developments.

41 Air Navigation Act (Cap 6, 2014 Rev Ed) ss 7 and 7A.

punishment upon conviction is a fine not exceeding \$20,000 (not exceeding \$40,000 or imprisonment not exceeding 15 months, or both, for subsequent convictions).⁴²

(f) Fly in a way that disrupts or interferes with any activity associated with a special event unless a permit has been obtained; if this is contravened, the punishment upon conviction is a fine not exceeding \$20,000 or an imprisonment term not exceeding 12 months, or both.⁴³ However, the defence of reasonable care may be raised.⁴⁴

(g) Carry prohibited items; if this is contravened, the punishment upon conviction is a fine not exceeding \$100,000 or an imprisonment term not exceeding five years, or both.⁴⁵ However, the defence of reasonable unknowability may be raised.⁴⁶ It was also clarified in Parliament that if a person uses an unmanned aircraft or a drone as a weapon to carry out an attack, he can already be prosecuted under various existing statutes⁴⁷ that criminalise such acts, and penalties upon conviction range from long-term imprisonment to the death penalty.⁴⁸ Parenthetically, it must be said that this dual-track approach is correct and neutralises the highly irrational but deep-seated fear that drones would be the weapon of choice for terrorists. It recognises, implicitly at least, three fundamental truths: consumer drones, because of their limited payload and flight times, are extremely poor choices for mounting weapons; high-end drones, which do not have those limitations, are exceedingly expensive; and quite apart from how the average user has no terroristic intent, no drone legislation is going to

42 Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) paras 72E and 80(5).

43 Public Order Act (Cap 257A, 2012 Rev Ed) s 32. Special events are those which the Minister has by order published in the *Gazette*, and include events such as the National Day Parade (and its rehearsals) and the Formula 1 race. Often, however, the no-fly-zones created for these events are unduly large and last for unduly long durations.

44 Public Order Act (Cap 257A, 2012 Rev Ed) s 32.

45 Air Navigation Act (Cap 6, 2014 Rev Ed) s 7B. A “prohibited item” is defined as anything the possession of which would constitute any offence under the Arms and Explosives Act (Cap 13, 2003 Rev Ed), Corrosive and Explosive Substances and Offensive Weapons Act (Cap 65, 2013 Rev Ed) and Dangerous Fireworks Act (Cap 72, 2014 Rev Ed), as well as any various items under the Biological Agents and Toxins Act (Cap 24A, 2006 Rev Ed) and Radiation Protection Act (Cap 262, 2008 Rev Ed), and other hazardous materials that the Minister has by order published in the *Gazette*.

46 Air Navigation Act (Cap 6, 2014 Rev Ed) s 7B.

47 For instance, if a person commits a terrorist bombing (as defined by s 3 of the Terrorism (Suppression of Bombings) Act (Cap 324A, 2008 Rev Ed), he will face either life imprisonment or the death penalty upon conviction.

48 *Singapore Parliamentary Debates, Official Report* (11 May 2015) vol 93.

deter a terrorist from building his own drone for terrorism purposes.

(h) Discharge or drop anything unless a permit has been obtained; if this is contravened, the punishment upon conviction is a fine not exceeding \$20,000.⁴⁹ However, the defence of reasonable care and mitigation may be raised.⁵⁰

(i) Weigh more than 7kg unless a permit has been obtained; if this is contravened, the punishment upon conviction is a fine not exceeding \$20,000 (not exceeding \$40,000 or imprisonment not exceeding 15 months, or both, for subsequent convictions).⁵¹

(j) Be used for commercial activities unless a permit has been obtained; if this is contravened, the punishment upon conviction is a fine not exceeding \$10,000 (not exceeding \$20,000 for subsequent convictions).⁵²

8 What is noteworthy at this juncture is that no specific law was introduced to address the privacy concerns raised during the parliamentary debates. Given that the status of a discrete tort of privacy in Singapore is ambiguous at best,⁵³ there is perhaps, as suggested in Parliament, only general recourse to the Protection from Harassment Act⁵⁴ if a person's personal life can even be said to be somehow subject to harassment by aerial imaging by a drone.⁵⁵ Indeed, most of the regulations listed above do not deal specifically with the issue of aerial

49 Air Navigation Act (Cap 6, 2014 Rev Ed) s 7C.

50 Air Navigation Act (Cap 6, 2014 Rev Ed) s 7C. However, it is no defence to claim that no one was injured or killed, no property was destroyed or damaged, or that no hazard was caused to another aircraft, another person or property.

51 Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) paras 72F, 72L and 80(5).

52 Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) paras 72D and 80(4).

53 See *AXA Insurance Singapore Pte Ltd v Chandran s/o Natesan* [2013] 4 SLR 545 at [5]–[10]. See also *Lim Meng Suang v Attorney-General* [2015] 1 SLR 26 at [44]–[49] and *ANB v ANC* [2015] 5 SLR 522 at [23].

54 Cap 256A, 2014 Rev Ed.

55 See also *Singapore Parliamentary Debates, Official Report* (11 May 2015) vol 93:

Privacy-related incidents where a person uses an unmanned aircraft to pry into another person's property and privacy will be investigated on a case-by-case basis. As a general principle, enforcement action will be taken against users whose activities constitute an offence under existing laws such as the Penal Code and the Protection from Harassment Act 2014. The inter-agency Unmanned Aircraft Systems (UAS) Committee ... is also looking into a comprehensive framework on the use of unmanned aircraft in Singapore and will look specifically and more deeply into the issue of privacy, to see if our current laws are adequate and if any regulatory enhancements are needed.

However, given that the Minister for Transport retired from politics shortly after this Bill was introduced, it is unclear if the committee in question has continued with its task.

imaging, and are focused instead on general drone misuse that may lead to danger or a compromise of security. The issue of privacy is something that will be considered again in greater detail at subsequent points of this article. For now, it bears mention that the following prohibitions (which are presumably subject to the pilots’ obtainment of the relevant permits) have also been declared by CAAS,⁵⁶ but the precise legal bases for some of these prohibitions, as well as their legal status, remain unclear:

- (a) Flying over crowds or busy roads.
- (b) Flying in a way that interferes with emergency responders such as policemen, firemen and ambulances.
- (c) Flying in bad weather or bad visibility conditions.
- (d) Using prohibited frequencies or using batteries that exceed prescribed limits.
- (e) Flying without line-of-sight (which means sole reliance on first-person-view technology is prohibited; what is less clear is whether a spotter may be used instead).
- (f) Flying at night (which is presumably interpreted broadly to include low-light conditions).⁵⁷

9 These ambiguities aside, law enforcement officers have also been given the following powers as a result of the changes to the law in 2015; these changes are important to note because they spell out what may happen to the drone user and his drone if a violation of the law is imminent or being committed:

- (a) If an authorised person has reason to believe that an unmanned aircraft is being operated in a way that contravenes the Air Navigation Act or any aviation safety subsidiary legislation or that poses a serious and an imminent risk to public safety, he may direct the pilot to end the flight or fly it in a specified manner, with assistance and by force as is necessary assume control of the flight to end it or land the aircraft in the fastest and safest practicable way, or seize the aircraft if he has reason to believe it contains material evidence or that it will be

56 See Civil Aviation Authority of Singapore, “Fly it Safe” <<http://www.caas.gov.sg/caasWeb2010/export/sites/caas/en/ANS/unmanned-aircraft.html>> (accessed 5 December 2016).

57 This is one ambiguity that ought to be explored. Briefly, even assuming this is an enforceable rule, one has three main options when deciding what qualifies as night flying: a cut-off based on the daily sunset and/or sunrise time; a fixed window every day, throughout the year; and leaving it to pilot judgment. Most jurisdictions have left the issue undefined, but this is mainly because they experience multiple seasons and dramatic light changes every year.

concealed, lost, destroyed or used in the continuation of an offence.⁵⁸

(b) If an authorised person has reason to believe that an unmanned aircraft is being operated in a way that may interfere with a special event (as defined in the Public Order Act) or that poses a serious and an imminent risk to the security or safety of persons attending the event, he may direct the pilot to end the flight or fly it in a specified manner, with assistance and by force as is necessary assume control of the flight to end it or land the aircraft in the fastest and safest practicable way, or seize the aircraft if he has reason to believe it contains material evidence or that it will be concealed, lost, destroyed or used in the continuation of an offence.⁵⁹

(c) An authorised person may require a person whom he has reasonable grounds to suspect is just about to contravene Pt XA of the Air Navigation Order to furnish his name, address, or other proof of identity on demand; refusal to comply without reasonable excuse or the reckless furnishing of false information is an offence punishable with a fine not exceeding \$20,000 (not exceeding \$40,000 or imprisonment not exceeding 15 months, or both, for subsequent convictions).⁶⁰

10 Having set out the key aspects of the current regulatory framework for recreational drone users in Singapore, we turn to the question of whether there are any problems or gaps that need to be addressed. In doing so, some of the main features of current drone technology, as well as the approaches adopted by other jurisdictions where appropriate, will be considered.

58 Air Navigation Act (Cap 6, 2014 Rev Ed) s 29G. An “authorised person” is a police officer, or an auxiliary police officer, of or above the rank of sergeant and authorised by the Commissioner of Police to exercise powers under the provision or a safety inspector or individual with the suitable qualifications and experience authorised by the Civil Aviation Authority of Singapore to exercise powers under the provision.

59 Public Order Act (Cap 257A, 2012 Rev Ed) s 32A. An “authorised person” is a police officer, or an auxiliary police officer, of or above the rank of sergeant and authorised by the Commissioner of Police to exercise powers under the provision.

60 Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) paras 72K and 80(5).

III. Current and potential problems with regulatory framework and some possible solutions

A. *Absence of other limits: Distance, speed and proximity*

11 Based on existing regulations, we know without doubt that by default, drones may not be flown 200ft above mean sea level and/or within 5km of any aerodrome. But height and proximity-to-airport limits, although a legacy of prior legislation that governed other types of unmanned aerial vehicles, are fairly conventional in legislation around the world, and any divergence between the laws in different countries is to be found in the extent of the limits (for which Singapore is on the restrictive end of the spectrum), rather than the existence of the limits.⁶¹ What are actually less conventional, though one would have thought to be logical to provide for, are distance, speed and proximity limits – and these are not provided for at all in the local regulatory framework. These limits, and the purpose in providing them, will be discussed in turn.

12 Beginning with distance limits, one may argue that they are already implicit in the requirement of line-of-sight when flying. One big problem with this, as alluded to earlier, is that the requirement of line-of-sight, as it is with the prohibitions on night flights and flights over crowds, finds no direct or clear expression in the regulations. It appears only to be a guideline or good practice recommended by CAAS, and if so, it has no binding force and cannot be enforced.⁶² At any rate, the point of having in place a distance limit goes beyond the formalistic concern of certainty in the law. It is also about having regulations that cohere and are consistent with one another. If this aspect of the regulations is left undefined and open-ended, it is an unintended anomaly that potentially undermines what is otherwise a fairly restrictive framework.

13 To illustrate, assuming there is not much variance between how far different human eyes can see, whether a drone is within line-of-sight is ultimately going to depend on the characteristics of the drone in question, such as its size, colour, light signals and audibility, and the

61 Many countries (see for instance France, New Zealand and the UK) impose a height limit of 400 to 500ft (with reference to the take-off spot, rather than using mean sea level) for recreational users, while the airport-proximity distance typically ranges from 4km (for instance New Zealand) to 10km (for instance South Africa).

62 In contrast, interference with emergency providers is clearly provided for in other sources of law, such as s 44 of the Fire Safety Act (Cap 109A, 2000 Rev Ed). This is not to say the Civil Aviation Authority of Singapore is not authorised to create regulations, but the line-of-sight requirement is not currently couched as a mandatory rule.

presence of other drones when in flight. A DJI Phantom 4 and DJI Inspire 1 Pro⁶³ – two of the most popular quadcopters on the ever-burgeoning market today, and both well within the 7kg, recreational class – are vastly different in the said characteristics, and therefore present very different line-of-sight results: on a bright day and without tall obstructions (and here weather conditions and topography present more variables yet), one estimates that a Phantom 4 is probably going to be within line-of-sight up to 1,000ft away (notably, the just-released DJI Mavic, which will supersede the Phantom line, is even smaller).⁶⁴ The much larger and more conspicuous Inspire 1 Pro⁶⁵ will probably remain visible up to 2,000 or even 3,000ft away – and signal loss is not an issue yet at this distance, given that the Inspire 1 Pro can be controlled up to 5km away if there is not too much wireless interference.⁶⁶ These numbers stand in stark contrast to the altitude limit of a measly 200ft and do not produce an internally consistent picture if safety is a paramount concern: how is it that 200ft is too high, but 3,000ft or more is not too far away in the eyes of the law?

14 Indeed, it would not be fanciful to suggest at all that a drone being flown 3,000ft away from the pilot (but within the 200ft altitude limit) is more dangerous than a drone being flown more than, say, twice the 200ft limit above the pilot but comfortably within line-of-sight. Yet if the authorities were to act (as they are authorised to do, as we have seen above, under the Air Navigation Act and Public Order Act) because they believe a pilot is posing a serious and imminent risk to public safety, they could actually end up exacerbating the danger in the scenario where the drone is far away, but the blame may be pinned on the pilot. Trying to commandeer the drone may result in a loss of line-of-sight, and trying to land the drone from afar without line-of-sight is self-explanatorily hazardous. And in the first place, how does one, for the purposes of arrest or prosecution, refute the pilot's claim that the drone was indeed within his line-of-sight? If there is an express distance limit prescribed, the drone app and flight logs would be able to show, among other various flight parameters, how far the drone was away from the pilot and the pilot can make the necessary adjustments accordingly.⁶⁷

63 The Inspire 2 and Phantom 4 Pro were released shortly after this article was first submitted, and while they boast impressive upgrades in specifications for hardware and software, they do not affect the core arguments made in this article.

64 DJI, "Mavic Specs" <<http://www.dji.com/mavic/info>> (accessed 5 December 2016).

65 The Inspire 1 Pro weighs around 3.5kg, or almost three times the weight of the Phantom 4; its diagonal size is 559mm as compared to the Phantom 4's 350mm: DJI, "Inspire 1 Pro/Raw Specs" <<http://www.dji.com/inspire-1-pro-and-raw/info#specs>> (accessed 5 December 2016).

66 DJI, "Inspire 1 Pro/Raw Specs" <<http://www.dji.com/inspire-1-pro-and-raw/info#specs>> (accessed 5 December 2016).

67 See for instance DJI, "DJI Go" <<http://www.dji.com/goapp>> (accessed 5 December 2016). Further, under s 116A(1) of the Evidence Act (Cap 97, 1997 Rev Ed):

(cont'd on the next page)

Without an express limit but only a requirement for line-of-sight, it would be much more difficult, both at the point of trying to prevent an accident and when the matter is investigated or prosecuted, to refute the pilot’s claim that the drone was indeed in his line of sight.⁶⁸ It is not enough to dismiss a distance limit rule simply on the basis that some drones would be less or more visible than others.

15 A related issue to consider is whether having a spotter satisfies the line-of-sight requirement. Despite the inherent solitary nature of the activity, not all drone users fly alone – for more complex flights, it is common for the pilot to have a spotter located somewhere along the flight path, or to have a separate pilot controlling only the camera. This is usually done when the pilot is going to rely solely on first-person-view for the purposes of piloting the drone, and the spotter or co-pilot is put in place to locate the drone in case the video stream gets cut. In the US, it appears that drone users are allowed to fly their drones beyond their line-of-sight, provided that there is a spotter elsewhere to maintain line-of-sight.⁶⁹ So long as the spotter is able to communicate with the pilot remotely, the line-of-sight is artificially increased this way. Presumably, more than one spotter may be used for this purpose. This is something the Singapore authorities do not appear to have considered, quite apart from whether line-of-sight is even a strict requirement. The other obvious possibility in this area of regulation is to insist on an express distance limit, as is done in countries such as Germany (300m),⁷⁰ South Africa (500m)⁷¹ and the UK (500m).⁷²

[W]here a device or process is one that, or is of a kind that, if properly used, ordinarily produces or accurately communicates an electronic record, the court shall presume that in producing or communicating that electronic record on the occasion in question, the device or process produced or accurately communicated the electronic record.

However, as mentioned, the app may measure altitude based on the take-off spot rather than, say, mean sea level. In this specific respect, unless this is made clear in the operation manual for the app, can one assume that the app’s data is accurate for the purposes of complying with the regulations?

- 68 Using s 108 of the Evidence Act (Cap 97, 1997 Rev Ed) – which states that a party bears the burden of proving facts particularly within his knowledge – would not be very helpful either. How is he supposed to prove that the drone was within his line-of-sight other than just insist that it was?
- 69 Federal Aviation Administration, “Summary of Small Unmanned Aircraft Rule (Part 107)” <http://www.faa.gov/uas/media/Part_107_Summary.pdf> (accessed 5 December 2016).
- 70 Wilde Beuger Solmecke Rechtsanwälte, “Civilian Drones and the Legal Issues Surrounding Their Use” <<https://www.wbs-law.de/internetrecht/civilian-drones-legal-issues-surrounding-use-50459/>> (accessed 5 December 2016).
- 71 Library of Congress, “Regulation of Drones: South Africa” <<https://www.loc.gov/law/help/regulation-of-drones/south-africa.php>> (accessed 5 December 2016).
- 72 Sophie Curtis, “Drone Laws in the UK – What are the Rules?” *The Telegraph* (16 April 2016).

16 What about speed limits? This omission appears to be another puzzling gap in the regulatory framework. However, this gap is probably explainable again by the historical fact that until drones (in the form as we know them today) became mainstream in the last couple of years, the air navigation legislation largely only contemplated the use of radio-controlled model aircraft (“RCA”) as far as unmanned aircraft were concerned – the sort that were used primarily for racing or acrobatics rather than aerial imaging.⁷³ Such aircraft were also relatively large and were usually powered by fuel (at least in the past) rather than lithium polymer batteries. Many models could (and still can) easily reach top speeds in excess of a few hundred kilometres per hour, and the assumption could have been that so long as the users of such aircraft exercised reasonable care in the general sense, speed limits need not and should not be imposed since the whole point of racing and aerial acrobatics is to fly at high speeds. The other probable assumption is that because there was only a small and relatively defined community of RCA users, their activity was seen as a niche hobby and the authorities were quite happy to leave them to regulate their own space, especially since speeding and acrobatics do not by their nature demand high altitudes, unlike aerial imaging. Vertical, and not lateral airspace, was the primary concern of the authorities. Further, whereas drone imaging enthusiasts seek to unlock the latest never-seen-before vista and will not be content in just flying in fixed locations, those into racing and acrobatics were able to conduct their activity in fixed and secluded areas; it was in their interests to find a flying location that was open and safe, and the aesthetic qualities of the surrounding landscape were probably completely irrelevant to them. The upshot of all of this, however, is that drones are now inheriting another aspect of the regulatory legacy of a very different type of aerial vehicle that has always been used for a very different type of activity. Appreciating this then forecloses the potential objection that drones used for aerial imaging are only capable of relatively modest speeds – for instance, the Inspire 1 Pro has a maximum speed of 18m/s or 64.8km/h,⁷⁴ and there are many other faster models – because while drones are not designed to reach very high speeds, their less predictable flight paths, dependent on the images and footage sought by the pilot, may warrant speed caps. In other words, the law should be more nuanced and not treat all unmanned aerial vehicles as a monolithic, undistinguishable entity that only has a

73 Before the 2015 amendments, the Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) only contemplated the use of kits and parasails (para 64), captive balloons (para 64A), free flight aerial objects (para 64B) and model aircraft and unmanned airships (para 64C). Paragraph 64C has since been deleted and replaced with the omnibus Pt XA.

74 DJI, “Inspire 1 Pro/Raw Specs” <<http://www.dji.com/inspire-1-pro-and-raw/info#specs>> (accessed 5 December 2016).

singular use with indistinguishable attendant risks. There is little justification for drones used in aerial imaging to travel at racing speeds.

17 Having said that, how does one rationalise the fact that speed limits for drones have also not been imposed in many other jurisdictions as well, including jurisdictions that have studied the matter very closely before modifying their drone laws? For instance, countries such as Australia, Canada, Germany, Hong Kong, South Africa, the UK and the US have, like Singapore, not seen fit to include speed limits in their latest drone regulations.⁷⁵ In this connection, one may also point to the aforementioned general obligation to fly safely, which is mandated by the Air Navigation Order,⁷⁶ as a possible workaround: a drone pilot who flies safely is not a drone pilot who will fly at too high a speed. Indeed, one may even go one step further and argue that quite apart from the line-of-sight requirement, this general obligation also encompasses the duty not to fly the drone at too far a distance, thus obviating the need to create a discrete cap for drone-to-pilot distance. But there are no less than four counterpoints to subsuming all types of express limits under a general duty to fly safely, notwithstanding the ostensible flexibility afforded to both pilots and regulators through a broad rule.

18 First, what exactly would be considered speed so excessive that it crosses the threshold of safety? While one appreciates the fact that different classes of drones present different degrees of danger when flying at high speeds, the better way forward may be to prescribe different speed limits based on factors such as the weight and class of drone, the presence of safety features in the drone, pilot expertise and the activity in question. Again, as is the case with drone-to-pilot distance, the speed at which the drone is travelling is easily determined by drone apps that instantly reflect flight parameters, and for forensic purposes they are captured in the flight logs as well. Secondly, the fact that a distance limit may, together with a speed limit, be conceptually subsumed under a general duty to fly safely does nothing to surmount the practical difficulties stated above with respect to both the user’s regulation of his conduct and the enforcement of the rule. Thirdly, many shades of conduct can be classified as a likely endangerment to the safety of persons or property, but with very different consequences. A simple illustration suffices to make this point.

19 In one scenario, suppose a person pilots his drone from 3,000ft away (but within line-of-sight) and at the maximum speed the drone is capable of (say, 65km/h), and due to the battery running out during the

75 Chen Siyuan, “Comparative Analysis of “Anti-Drone” Legislation”, Conference Presentation at HKU-NUS-SMU Symposium (2016).

76 Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) paras 72E and 80(5).

return route the drone crash-lands into a public gathering of people, severely injuring a number of them. In another scenario, a person pilots his drone at a low speed and comfortably within line-of-sight but due to a parallax error he crashes it into a building, damaging a few glass windows. As stated earlier, the punishment for dangerous flying is a \$20,000 fine,⁷⁷ but while the former scenario clearly entailed a more egregious violation and greater threat to persons and property than the latter scenario, they would both fall under the same offence, and given the relative nascence of the activity, the pressure on the authorities to prosecute and convict either offender is equally high. Putting aside the difficulty of proving that the pilot was acting more recklessly in one scenario over the other, it seems entirely open for the pilot to argue that he was not doing anything unsafe as he was not flying the drone at that great a speed and, further, his drone was still within line-of-sight. This leads us to the final counterpoint to subsuming distance and speed limits under a general duty to fly safely, and the third gap regarding limits in our regulatory framework: without a clear and express rule for proximity to persons and buildings – CAAS’s recommendation for drones not to be flown near crowds appears again only to be a guideline and without a discernible legal basis – drone pilots will have yet another layer of difficulty trying to conform their conduct to an overly open-textured duty. Other jurisdictions have thus taken a different approach on this matter.

20 Specifically, instead of having only a general duty not to cause damage to persons or property, many jurisdictions have chosen to set express limits as to the distance that must be kept between the drone and persons and property.⁷⁸ For instance, in the UK, drones cannot be flown within 50m of people, vehicles, buildings or structures (though this only appears to apply to drones fitted with cameras – which means the concern goes beyond safety but includes privacy as well); further, drones cannot be flown over congested areas or large gatherings such as concerts and sports events.⁷⁹ In comparison, in Hong Kong, drones also cannot be flown over or within 50m of any person, vessel, vehicle or structure not under the control of the pilot; however, for take-off and landing, the limit is relaxed to 30m (but this limit does not apply to the pilot – the law sensibly recognises that the pilot needs to be close to the

77 Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) paras 72E and 80(5).

78 In other words, it is acceptable to have a general duty to fly safely (as is found in the legislation of jurisdictions such as Japan), but it is worth considering if such a duty should be supplemented with more precise rules, either across the board or on a drone-by-class basis.

79 Civil Aviation Authority, “The Dronecode” <<https://www.caa.co.uk/Consumers/Model-aircraft-and-drones/The-Dronecode/>> (accessed 5 December 2016).

drone when it takes off and lands).⁸⁰ Most other jurisdictions adopt positions between these two ends of the spectrum, though some set more extreme limits. For instance, in Canada, drones cannot be flown closer than 150m from people, animals, buildings, structures or vehicles, and also cannot be flown in populated areas or near large groups of people (including sporting events, concerts and the like).⁸¹ For an example of a more permissive approach, in Thailand, no specific proximity limit is prescribed save that drones may not be flown over crowded areas (so this is similar to Singapore, except that the flight-over-crowds probation only appears to be a guideline and not captured in the legislation here).⁸²

21 Then there are jurisdictions that apply proximity limits in conjunction with the previously discussed distance limits. In France, drones cannot be flown more than 200m away from the pilot – but a height limit of 500ft applies – and they also cannot be flown over densely populated towns or cities.⁸³ This limit exists on a sliding scale with respect to one particular dimension, however. The 200m limit applies to recreational fliers of drones that weigh less than 2kg. For larger and heavier drones, the distance limit is increased up to a kilometre, but permits and certifications may need to be obtained as greater dispensations are sought.⁸⁴ For comparison, in Germany, the aforementioned flat distance limit of 300m is imposed, together with the prohibition of flying near crowds or gazetted areas.⁸⁵ So Singapore’s drone regulations not only do not contain distance limits and speed limits, they also say nothing specific about proximity to persons, crowds or property – save of course that places that have been designated as danger, prohibited, protected or restricted areas by the Government may

80 Civil Aviation Department, “Operations of Unmanned Aircraft Systems (UAS)” <http://www.cad.gov.hk/english/Unmanned_Aircraft_Systems.html> (accessed 5 December 2016).

81 Transport Canada, “Flying Your Drone Safely and Legally” <<https://www.tc.gc.ca/eng/civilaviation/opssvs/flying-drone-safely-legally.html>> (accessed 5 December 2016).

82 UAV Systems International, “Thailand Drone Laws” <<https://uavsystemsinternational.com/drone-laws-by-country/thailand-drone-laws/>> (accessed 5 December 2016).

83 4 Revolution, “Drones: New Regulations in France for 2016” <<http://www.4erevolution.com/en/drones-une-nouvelle-reglementation-francaise-en-2016/>> (accessed 5 December 2016).

84 4 Revolution, “Drones: New Regulations in France for 2016” <<http://www.4erevolution.com/en/drones-une-nouvelle-reglementation-francaise-en-2016/>> (accessed 5 December 2016).

85 Wilde Beuger Solmecke Rechtsanwälte, “Civilian Drones and the Legal Issues Surrounding Their Use” <<https://www.wbs-law.de/internetrecht/civilian-drones-legal-issues-surrounding-use-50459/>> (accessed 5 December 2016).

not be flown over.⁸⁶ Perhaps the draftsmen thought that since it would be quite difficult to fly drones in crowded Singapore without being in fairly close proximity to persons or property, it would be fairer to drone users if the duty was just one of general care rather than one comprising specific limits. We do not know – but it is precisely because we do not know that it is equally open to make the inference that the Legislature assumed that drone users in Singapore would recognise the natural constraints presented and would simply avoid flying near persons or buildings to begin with.

22 All things considered, is it better to be as precise with the law as possible (but have a sliding scale for, say, different types of drones, skill level and activity), or to have a more flexible but inherently open-ended test of general duty not to endanger persons or property? After all, this would be no different from how the common law approaches the development of the law of torts (such as negligence, battery or trespass). The obvious difference between this and tort law, however, is that a violation of the drone regulations is a potential criminal prosecution with fairly drastic sentences upon conviction. No matter what virtues one can think of as regards leaving matters to prosecutorial discretion, this remains a new area of law and the users deserve to have the law presented with maximum clarity.⁸⁷ The answer also depends, in part, on how one views the state of drone technology and its foreseeable trajectory. When drones first became mainstream sometime in 2014, they were still prone to flyaways, loss of signal between drone and controller, loss of image signal, loss of GPS, compass error, battery failure, propeller failure, the controlling app crashing, bird attacks and a litany of other issues.⁸⁸ Most drones back then could barely clock a handful of flights before crashing beyond feasible repair. The modern drone, in contrast, is packed with impressive features that improve the overall safety and longevity of the machine, such as the seamless integration of GPS (usually together with GLONASS (Global Navigation Satellite System)) with flight controls that keeps the drone steady and also makes it flight-path programmable, multi-directional VPS (vision positioning system) and anti-collision sensors that help prevent the drone from colliding into objects while in flight (especially when flying indoors), reliable first-person-view stream (which is a great insurance when line-of-sight is lost), subject-matter view to complement the first-person-view, propeller redundancy, computer core redundancy, programmable auto-land and auto-return-home contingencies, object-

86 Air Navigation Order (Cap 6, O 2, 1990 Rev Ed) paras 72D and 72E; Air Navigation Act (Cap 6, 2014 Rev Ed) ss 7 and 7A.

87 See generally Chen Siyuan, “The Limits on Prosecutorial Discretion in Singapore: Past, Present, and Future” (2013) 2(1) *International Review of Law* 1.

88 Jack Nicas, “What Happens When Your Drone Escapes” *The Wall Street Journal* (8 December 2014).

tracking pre-configuration, real-time feedback of impending machine malfunction, to name but a few breakthroughs.⁸⁹ Optional accessories (some of which are already integrated with newer drones) that enhance safety to varying degrees include battery redundancy, computer core and sensor redundancy, parachute systems, propeller guards, weather-resistant components and modified landing gear.⁹⁰

23 In a nutshell, the modern consumer drone is very easy to control and programme, much less likely than before to crash (whether through pilot error, failure to perform pre-flight procedures, machine malfunction or a bird strike), and even if it is about to get into an accident, safety features may kick in to greatly reduce any damage to persons or property. With the passage of time, the safety features and airworthiness of drones are only going to get much better. The law can also facilitate this, in that manufacturers can be mandated to include some or all of the aforementioned safety features in their drones – whether through hardware design (such as propeller and battery redundancies, complementary cameras, parachute systems or even speed caps) or software updates (such as creating and updating, in regular consultation with the authorities, geo-fenced no-fly-zones via the app used to pilot the drones so that users do not need to guess where the prohibited, protected and restricted areas are) – before they can be sold, and drones that do not meet these safety standards can be banned from importation and sale. Such an imposition would not be an undue intervention with the freedom of commerce, since it is in the interests of both drone makers and drone users to be able to fly drones safely, and more importantly such technologies already exist and do not add much to costs. Further, the extent of the safety features required should also depend on the drone and the activity. Generally, the heavier the drone and the more complex the activity, the more safety features should be mandated. Allowing manufacturers to work with regulators also obviates the intractable difficulties associated with mandating drone insurance for recreational users.⁹¹

24 Accordingly, if the legislative focus is going to be solely on safety⁹² – as evinced by the other existing prohibitions relating to danger, prohibited, protected and restricted areas as well – it stands to reason in

89 Scott Gilbertson, “Review: Yuneec Typhoon H” *Wired* (30 May 2016).

90 Sean Gallagher, “New Drone Parachute Saves Falling Drones – And the People Under Them” *ARS Technica* (5 April 2016).

91 See generally Daniel North, “Private Drones: Regulations and Insurance” (2015) 27(2) *Loyola Consumer Law Review* 334.

92 That is, safety in terms of reliability of the technology so that persons and property would not be damaged when crashes occur. The flipside to reliable drone technology is that drones may then become suitable modes of transport or even weapons for criminals.

the light of these technological developments to eschew an overly categorical approach to regulation, whether for the time being or in the future. One problem with this, as alluded to earlier, is that a drone accident can expose the user to both civil and criminal penalties at the same time, so he needs to know exactly what sort of conduct could potentially land him in trouble. Another problem is that drones are not just seen as being potentially unsafe. As witnessed during the parliamentary debates surrounding the Unmanned Aircraft (Public Safety and Security) Bill, drones are widely seen as a significant threat to privacy rights as well.

B. *Perceived threats to right to privacy and other related rights*

25 But for there to be an alleged breach of privacy, such a right must exist in the first place. It was mentioned earlier that a discrete right to privacy may not exist in Singapore. On another view, however, some manner of a right to privacy does exist in Singapore, but it is manifested only in bits and pieces, and in very particular forms within very particular contexts. One such instance may be found in the Personal Data Protection Act 2012,⁹³ but as s 3 of the legislation itself states,⁹⁴ the statute is focused on how personal data is collected and commercially exploited by business organisations, and is not exactly meant to protect individuals from having their photographs taken by recreational users of drones.⁹⁵ As it were, photographers can freely take images and videos of persons in Singapore without their consent provided that the setting is public and no crime is committed in the process,⁹⁶ so why should drone users, often armed with far less capable cameras, be treated differently? Similarly, the anti-harassment legislation that was mentioned during the parliamentary debates is meant to target anti-social behaviour such as workplace harassment, stalking and cyber-bullying, and may not necessarily give rise to a discrete right to privacy properly so called.⁹⁷ In

93 Act 26 of 2012.

94 Section 3 of the Personal Data Protection Act 2012 (Act 26 of 2012) states:

The purpose of this Act is to govern the collection, use and disclosure of personal data by organisations in a manner that recognises both the right of individuals to protect their personal data and the need of organisations to collect, use or disclose personal data for purposes that a reasonable person would consider appropriate in the circumstances.

95 See also Personal Data Protection Commission Singapore, “Legislation and Guidelines: Overview” <<https://www.pdpc.gov.sg/legislation-and-guidelines>> (accessed 5 December 2016).

96 See Personal Data Protection Commission Singapore, “Advisory Guidelines on the PDPA for Selected Topics: Photography” <[https://www.pdpc.gov.sg/docs/default-source/advisory-guidelines---selected-topics/photography-\(chapter-9\)-110914.pdf?sfvrsn=2](https://www.pdpc.gov.sg/docs/default-source/advisory-guidelines---selected-topics/photography-(chapter-9)-110914.pdf?sfvrsn=2)> (accessed 5 December 2016).

97 See *Singapore Parliamentary Debates, Official Report* (13 March 2014) vol 91 in which the Protection from Harassment Bill was being debated.

fact, the word “privacy”, or any of its grammatical variants, do not appear in either legislation, and this suggests the right not to be photographed or videoed, whether by a drone or otherwise, just does not exist.

26 This is not to say that it is technically impossible for a drone user to commit a violation of either the data protection statute or anti-harassment statute. In respect of the former, however, the user of the drone must be exploiting the photograph(s) or video(s) of the individual(s) in question for commercial gain before any claim for data protection can be made,⁹⁸ and it is not in the interests of a commercial drone user to recklessly intrude into the space of random individuals. As regards the latter, a drone is simply not a very viable tool to intentionally cause harassment, alarm or distress via “threatening, abusive or insulting words or behaviour”⁹⁹ or to intentionally cause someone to believe that unlawful violence will be used against the victim via “threatening, abusive or insulting words or behaviour”.¹⁰⁰ A user who pilots the drone in such a way is more likely a source of amusement or irritation than a true harasser who can cause mental harm – and in any event would be already prohibited from piloting the drone recklessly by virtue of the existing regulations.¹⁰¹ However, it should be noted that since it is possible to stalk someone through a course of conduct that causes “harassment, alarm or distress” and stalking includes loitering in any place outside or near a person’s place of residence, it is possible that repeatedly flying a drone near the victim’s home may constitute an offence.¹⁰²

27 In any case, one may look beyond mental harm and equate privacy with the right not to be spied upon, but the modern consumer drone is highly unsuitable for surveillance. This is because unlike military-grade drones, consumer drones are not able to fly at very high altitudes, are highly conspicuous with blinking lights, are extremely noisy even when more than a hundred metres away, typically have a maximum flight time of 15 minutes, and are easily disrupted by wireless interferences or wind tunnels in urban areas – if effective spying

98 Personal Data Protection Act 2012 (Act 26 of 2012) Second Schedule.

99 Protection from Harassment Act (Cap 256A, 2015 Rev Ed) s 3. Section 4 creates a similar offence but has a lower *mens rea* requirement.

100 Protection from Harassment Act (Cap 256A, 2015 Rev Ed) s 5. Section 6 pertains to abuse against public servants or public service workers.

101 It is accepted, however, that if the user should post and circulate any embarrassing images on, say, social media, there could be some cause for concern, but the blame cannot be laid squarely at the feet of drones.

102 Protection from Harassment Act (Cap 256A, 2015 Rev Ed) s 7. The *mens rea* here is not limited to intention but includes a situation where the accused person “knows or ought reasonably to know” that his actions will cause harassment, alarm or distress.

requires stealth and a powerful imager, the modern consumer drone has absolutely none of those things.¹⁰³ Thus, if neither the Personal Data Protection Act nor the Protection from Harassment Act gives individuals a right not to have their photographs taken by drones and there is also, as mentioned earlier, nothing in the common law that supports a right to privacy and nothing in the current regulatory framework for drones that even comes close to creating privacy rights, it cannot be said with great confidence that Singapore drone laws were designed with enforceable privacy concerns in mind.

28 Be that as it may, it was also mentioned in Parliament when the Unmanned Aircraft (Public Safety and Security) Bill was debated that privacy concerns would be something the Government would look at more closely in due course. When that time comes, it is essential that any modifications to the regulatory framework are based on a proper understanding of how drones work. Moreover, we do not want a situation where people feel a need to take matters into their own hands by acquiring, for instance, drone jammer technology just to protect their own privacy – such tools are only going to cause much more harm than good.¹⁰⁴ Proceeding, therefore, on the assumption that a right to privacy exists or will eventually exist in Singapore, how should that be taken into account as far as drone regulations are concerned? To be clear, there was perhaps once a time not too long ago, when it could not seriously be contended that recreational drones could be used to capture usable photographs or videos of individuals. Such a conclusion was predicated on the fact that for a long time, consumer drones were, without exception, fitted only with prime wide-angle lenses (usually 20mm or less, based on the 35mm format) that could not be detached, and mounted in front of sensors that were smaller than those found in mobile phones (therefore no larger than 1/3.2” or at most 1/2.3”) – in other words, any sort of aerial imaging to be done by drones was confined to panoramic photography in the daytime, and getting close-up images of any quality were a total impossibility, unless the drone was flying in extremely close proximity to the individual and there were also no obstacles in the way.¹⁰⁵ The only alternative to this was to use a drone with a very high payload, but that would bring it outside the 7kg class and beyond the default regulatory framework for drones – meaning a whole other suite of requirements such as permits and certifications

103 See generally Chen Siyuan, “The Regulation of the Recreational Use of ‘Drones’ for Aerial Photography and Videography: Comparing Singapore’s Unmanned Aircraft Act with Other Legislation” (2015) 33 Sing L Rev 55.

104 Sean Gallagher, “Dronebuster Will Let You Point and Shoot Command Hacks at Pesky Drones” *ARS Technica* (20 May 2016).

105 See generally Chen Siyuan, “The Regulation of the Recreational Use of ‘Drones’ for Aerial Photography and Videography: Comparing Singapore’s Unmanned Aircraft Act with Other Legislation” (2015) 33 Sing L Rev 55.

would need to be complied with. That situation changed considerably with the introduction of the Inspire 1 Pro in 2015.

29 Though only a prosumer-level drone, the Inspire 1 Pro represented not just a light refresh of the original Inspire 1, but came with a far more complex multi-axis gimbal for smooth footage, a much larger sensor (micro four-thirds) spread over an improved 16 megapixels and most importantly a mount that supported a variety of detachable lenses, including optical zoom lenses.¹⁰⁶ To put matters into greater perspective, the drone’s sensor received a twelvefold upgrade in size over its predecessor, and with the use of longer interchangeable lenses such as the Olympus M.Zuiko 45mm f1.8 (giving a focal length of 90mm, based on the 35mm format), the Inspire 1 line suddenly became a rather viable tool for highly stabilised, medium-telephoto work.¹⁰⁷ In short, it is now possible to do high-quality medium-range portraiture using widely available drones such as the Inspire 1 Pro. But technology has not surmounted all obstacles yet. The fact remains that large drones (that is, at least the size of the Inspire 1 Pro) are still needed for stabilised, high-quality imaging, and large drones are not just very visible, but very loud as well. It also remains a fact that large drones are still needed to counteract medium to strong winds; small drones would be blown away by the slightest of winds, or at the very least they would be extremely difficult to pilot. Both of these facts are governed by the basic laws of physics, and it would take some time before technology finds a solution or a workaround. In the meantime, therefore, the fear that pocket-sized drones can freely be used to spy on unsuspecting persons is an overblown one.¹⁰⁸ The real issue, it seems, is not whether drones are likely to be used to spy on others since they are terribly ineffective in doing so, but whether drones can be flown in a way that affects an individual’s rights to enjoy certain spaces. In particular, can a person legally fly a drone over another person’s property? Does a homeowner own any airspace above his property?¹⁰⁹ At what point does

106 DJI, “Zenmuse X5 Series Specs” <<http://www.dji.com/zenmuse-x5s/info>> (accessed 5 December 2016).

107 The focal length of 90mm is considered at best belonging to the medium telephoto range, but it is a matter of time before the focal length (and sensor size) options increase.

108 It is of course possible for a voyeur to pilot a mini drone into a person’s house, but at this point in time for a drone to be of a size to remain out of sight, the drone needs to have a very powerful and stabilised camera (relative to its size) – such technology is not available yet. When it does become available it may be necessary to see if such objects should be banned outright, if they serve no other purpose than to spy on others.

109 A related issue is whether a drone may take off from a public area but fly over an area where flying is not allowed by the owner. In the US for instance, the National Park Service had unilaterally banned the flying of drones in its national parks, but
(cont’d on the next page)

it become trespass (whether in the civil or criminal sense)? Looking at our own regulatory framework and related laws,¹¹⁰ there is no obvious answer. Perhaps this is yet another reason why it might be helpful to have proximity limits written into the law, so that this problem does not arise to begin with.

30 Looking abroad, the approach taken in other jurisdictions is far from uniform. We have earlier seen in the example of the UK that drones that are fitted with cameras cannot be flown within 50m of persons or buildings.¹¹¹ Unlike Singapore, the right to privacy is clearly established in the UK.¹¹² The limit of 50m, however, appears to address the concern of safety (in that drones may crash into persons or buildings) and trespass (since homeowners are unlikely to own that high an amount of airspace) rather than privacy. This is because even with a camera with some degree of telephoto ability and a large sensor, the privacy of a person is unlikely to be infringed upon when the drone is no less than 50m away – any person captured in the footage of a drone flying past will barely be identifiable because of the distance (never mind the other critical ingredient to establish a breach, which is the intent of the user). But this will change eventually when drones can be equipped with cameras that have greater telephoto or zoom abilities without an over-compromise on sensor and gimbal sizes, so how should the conduct of drone users be regulated in a future-proof way? How is using a drone with telephoto abilities truly fundamentally different from someone who uses a telescope, binoculars or camera with a telephoto lens? Do drones really represent a significant privacy threat greater than the many technologies already woven in our lives without much resistance on our part, such as the metadata trails left on social media and e-commerce websites, dashboard cameras and CCTVs that capture a wide array of personal data every day, and smartphones with advanced

users have circumvented this unreasonable prohibition by taking off from outside the park.

110 For instance, the Land Titles Act (Cap 157, 2004 Rev Ed) defines land to include “the column of airspace above the surface whether or not held apart from the surface as is reasonably necessary for the proprietor’s use and enjoyment”.

111 It should also be noted that the concept of “freedom of panorama” remains protected in the UK. This may be another consideration behind the formulation of their rules.

112 As part of its obligations under the European Convention on Human Rights, the Human Rights Act 1998 (c 42) (UK) came into force in 2000. Article 8(1) states: “Everyone has the right to respect for his private and family life, his home and his correspondence.” There are two points to note, however. First, there are plans to repeal the Human Rights Act. Secondly, the obligations in the Human Rights Act are as between the State and the people, rather than citizens *inter se*. Recourse to the right may thus be found only in the common law.

digital imaging and geolocation capabilities?¹¹³ There are no easy answers, and even the jurisdiction that is trying to lead the way has struggled with finding a fair solution.

31 In the US, the Federal Aviation Administration (“FAA”), following years of deliberation and pressure from the full spectrum of lobbyists, finally released its first set of operational rules for drone users in the third quarter of 2016. Notably, while it came up with very specific regulations for drone safety, it was unable to come up with any rule relating to privacy.¹¹⁴ It pointed to the fact that even the National Telecommunications and Information Administration, which had more direct oversight over privacy rights *per se*, could only come up with a set of non-binding best practices on the issue.¹¹⁵ One explanation for this legal impasse is that while the right to privacy obviously receives protection in the US, it has to be counterbalanced against constitutional rights such as the freedom of expression, which entails a thick and broad conception and includes the right to fly drones for the purposes of gathering news, creating art and the like.¹¹⁶ What constitutes a reasonable expectation to privacy also varies greatly depending on the context,¹¹⁷ and the question of surface owners holding strict rights to exclude flying objects from invading the airspace above their land remains an unresolved one.¹¹⁸ It may thus take a while before the legal landscape in developed parts of the world changes for this aspect of drone regulation. To cite another example, Canada has essentially concluded that any foreseeable threat to privacy rights would emanate

113 See Parliament of Australia, “Eyes in the Sky: Inquiry into Drones and the Regulation of Air Safety and Privacy” <http://www.aph.gov.au/About_Parliament/House_of_Representatives/About_the_House_Magazine/Previous/ATH48/Eyes_in_the_Sky> (accessed 5 December 2016).

114 Federal Aviation Administration, “DOT and FAA Finalise Rules for Small Unmanned Aircraft Systems” <https://www.faa.gov/news/press_releases/news_story.cfm?newsId=20515> (accessed 5 December 2016).

115 The guidelines are found at National Telecommunications and Information Administration, “Voluntary Best Practices for UAS Privacy, Transparency, and Accountability” <http://www.ntia.doc.gov/files/ntia/publications/voluntary_best_practices_for_uas_privacy_transparency_and_accountability_0.pdf> (accessed 5 December 2016).

116 The First Amendment to the US Constitution reads:

Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the Government for a redress of grievances.

117 See generally Taly Matiteyahu, “Drone Regulations and Fourth Amendment Rights: The Interaction of State Drone Statutes and the Reasonable Expectation of Privacy” (2015) 48(2) *Columbia Journal of Law and Social Problems* 265.

118 See generally Troy Rule, “Airspace in an Age of Drones” (2015) 95(1) *Boston University Law Review* 155 and Michael Widener, “Local Regulating of Drone Activity in Lower Airspace” (2016) 22(2) *Boston University Journal of Science and Technology Law* 239.

from surveillance carried out by the Government (who would have exclusive access to military-grade drones that can fly for hours and have extremely sophisticated imaging technology), and not so much from recreational users.¹¹⁹ Hong Kong, in comparison, has concluded that recreational drones are even more intrusive than traditional surveillance devices, though privacy protection remains relatively nascent in the country.¹²⁰ But to cite an extreme example, Sweden's Supreme Administrative Court ruled just recently that any consumer drone that carries any camera presents an unacceptable threat to privacy as it is nothing but a tool for surveillance, effectively banning drones altogether and joining an ever-changing list of countries with regressive drone laws.¹²¹ If Singapore prefers to wait-and-see (as it usually does), there is a long way to go before any sort of international consensus or clear best practice emerges. This is not without consequence, however, as simply waiting and doing nothing about the current laws runs the risk of greatly reducing the number of users of drone technology.

32 Ironically, amidst all the cacophony of how drones might assail privacy rights, it is easy to lose sight of the fact that drone users may potentially have their own privacy rights curtailed as well. Even more ironic is that such privacy rights are usually given robust protection in privacy-conscious jurisdictions. What then are these rights? It was mentioned earlier that the modern consumer drone is piloted with the help of an app developed by the drone manufacturer, and such an app contains plenty of data, including flight routes (based on GPS information), flight manoeuvres (based on flight control stick movements), flight parameters (duration, height, speed, distance, *etc*) and personal data of the pilot (smartphone identity, e-mail address, images and videos taken, *etc*). All of the data on the app is automatically synced to a cloud database owned by the manufacturer, so no opportunity to withhold consent arises,¹²² and it is immediately apparent

119 Office of the Privacy Commissioner of Canada, "Will the Proliferation of Domestic Drone Use in Canada Raise New Concerns for Privacy?" <https://www.priv.gc.ca/en/opc-actions-and-decisions/research/explore-privacy-research/2013/drones_201303/#heading-005> (accessed 5 December 2016).

120 Office of the Privacy Commissioner for Personal Data, Hong Kong, "Guidance on CCTV Surveillance and Use of Drones" <https://www.pcpd.org.hk/english/resources_centre/publications/files/GN_CCTV_Drones_e.pdf> (accessed 5 December 2016).

121 The Supreme Administrative Court of Sweden, "Tillstånd Lråvs för Kamera på en Drönare men inte för Kamera i en bil" <<http://www.hogstaforvaltningsdomstolen.se/Om-Hogsta-forvaltningsdomstolen/Nyheter-fran-Hogsta-forvaltningsdomstolen/Tillstand-kravs-for-kamera-pa-en-dronare-men-inte-for-kamera-i-en-bil/>> (accessed 5 December 2016).

122 In the case of DJI, see DJI Forum, "DJI Go App Tutorials – How to Sync DJI Go Flight Records" <<http://forum.dji.com/thread-60428-1-1.html>> (accessed 5 December 2016).

how such information can be used in many different ways – including possible abuse. If one of the principal difficulties of enforcing drone regulations is figuring out who flew what and where and when, this cloud database becomes an absolutely invaluable resource for investigative purposes. Indeed, the manufacturer may be tempted to grant the authorities access to the data if it is concerned about being able to continue selling its products in the country, and the authorities can conceivably justify access, at minimum, on the grounds of accountability and public safety.¹²³ Having such access is much more advantageous than just having a drone owner registration system, which does nothing useful for investigating incidents or making users better pilots. The use of data generated by the drone app for the purposes of investigation and prosecution is definitely going to be another matter that legislatures worldwide have to grapple with for some time.

C. *Permits and permissions as a placebo*

33 We turn then to the third and final category of problems with Singapore’s current regulatory framework: the permits and permissions system. If the previous two sections were about sorting out the critical gaps in our regulatory framework for recreational users of drone imaging, this section is about the instances of (probably unintended) executive overreach and bureaucratic inefficiency in the framework that has the potential to paralyse the activity altogether within the next few years. After factoring in the aerodrome zones, and danger, prohibited and restricted areas – that is, without even including the protected and special event areas, which are gazetted on an *ad hoc* basis from time to time – the flyable areas for recreational users of drones in Singapore are fairly limited.¹²⁴ Notably, these areas do not even yet include all of Singapore’s 304 parks, nature reserves and reservoirs which the National Parks Board (“NParks”) has declared, without any apparent consultation or input from stakeholders, to be absolutely off-limits to drones.¹²⁵ The end result has been that recreational drone users are now effectively only allowed to congregate in the Marina Barrage and Marina Bay areas to fly, as no other truly viable spots have been identified and local users tend to err on the side of caution – but most of these users probably do not even realise that any sort of imaging done in the Marina Bay area actually requires approval and a hefty monetary deposit made to the

123 See also Personal Data Protection Act (Act 26 of 2012) Second Schedule.

124 See Annex 3 below.

125 National Parks Board, “Do’s and Don’ts” <<https://www.nparks.gov.sg/gardens-parks-and-nature/dos-and-donts>> (accessed 5 December 2016).

Urban Redevelopment Authority.¹²⁶ This is a rather bleak, if not patently absurd, state of affairs. The usual rejoinder to this is that if a user wants to fly in a greater number of locations and/or exceed the prescribed limits (such as altitude and weight), all he needs to do is to apply to CAAS for a permit. After all, one of the promises made when the Unmanned Aircraft (Public Safety and Security) Bill was debated was that CAAS would provide a fuss-free, one-stop solution for all permit applications.¹²⁷ But is the permit system truly viable for most users?

34 While it is true that CAAS has not gone down the extreme path of requiring all users of drones to earn pilots' licences and certificates of expertise – as was once seriously contemplated by some jurisdictions¹²⁸ – a perusal of the permit application form by CAAS is disheartening and would likely deter many users from even bothering to try seeking exemptions.¹²⁹ Suppose a user wishes to fly at an extended height of 400ft (which is the limit adopted in most jurisdictions) or wishes to fly a small consumer-level drone for a private event for a small fee as a favour for a friend (which does not require any permit or certificate in other jurisdictions such as the European Union).¹³⁰ Regardless of whether this user is obtaining an operator permit (which is valid only for up to a year) or an activity permit (which is valid only for *ad hoc* events) so that he can be exempted from some of the default prohibitions, he needs to figure out the answers to a litany of highly technical questions, including: the precise co-ordinates of where he intends to fly, the full flight profile of the flight, a proposed list of safety measures employed to prevent the loss of control of the drone, a proposed list of contingency measures in the event of loss of power, loss of signal, and loss of line-of-sight, and 13 matrices of complex risk assessment, to name but only a few requirements in a form that spans 22 pages. Further, for reasons unknown to the public, CAAS does not publish any ballpark of the costs and fees for any of its applications – presumably, the amount is only known to the applicant after each application has been processed. There is also no stated turnaround timeframe, as every application would (predictably) be treated on a case-by-case basis – but if prior statistics are anything to go by, the

126 Marina Bay, “Filming/Photography” <<https://www.marina-bay.sg/organise-events/filming-photography/filming-n-photography.aspx#tab-content>> (accessed 5 December 2016).

127 *Singapore Parliamentary Debates, Official Report* (11 May 2015) vol 93.

128 See for instance Ben Popper, “New FAA Rules Mean US Companies Can Fly Drones Without a Pilot’s License” *The Verge* (21 June 2016).

129 Civil Aviation Authority of Singapore, “Application for Unmanned Aircraft Systems Permit” <http://www.caas.gov.sg/caas/en/PDF_Documents/Others/CAAS_UAS_FormA.pdf> (accessed 5 December 2016).

130 Adem Ilker, “Regulating Commercial Drones: Bridging the Gap Between American and European Drone Regulations” (2016) 15(2) *Journal of International Business and Law* 313 at 319.

success rate of applications has been fairly low and the turnaround time no less than a few weeks.¹³¹ It would be quite different if the application process was simple, expedient and only cost a nominal fee for non-complex requests, but the current process is uniformly unpleasant for all types of requests. At bottom, the likelihood of being granted a permit is remote, the process is cumbersome and potentially costly, but most importantly, a system of permits and permissions misses the mark even if its purported *raison d'être* is to ensure safety and accountability – it is hardly a panacea to either of those concerns, and is little more than a placebo to assuage public fears. It presupposes that mishaps involving drones can largely be attributed to pilot error or pilot incompetence, but that is a questionable assumption in the light of the fact that drone crashes in earlier times were mostly down to machine malfunction but today, drone technology has evolved so much that drone safety is not much of an issue anymore. A permit system, in other words, only promotes accountability but does little for safety. A system that demands proven competence may help with safety, but may unduly chill or even freeze the activity altogether for many users. Thus, in formulating the regulations and their exemptions, instead of looking only at whether the activity in question is inherently risky and whether the pilot has great skill and experience, the regulators should be asking whether certain types of drones even present real dangers to begin with.

35 Further, creating a system of permits and permissions fossilises a culture of rigid regulations, and bureaucrats have zero incentive to take a permissive approach over a restrictive one. Such a culture may arguably be more acceptable for something that is technologically agnostic, but will not work for something like drone technology which is evolving very quickly and is outpacing the development of the general regulatory framework. Further, users are already and will remain greatly deterred from continually reapplying for exemptions, and over time, the activity will inexorably die out. The experience of the US is instructive in these two regards. When FAA was first tasked to integrate drone airspace with the national airspace, its first reaction, as mentioned, was to require all drone pilots to possess a pilot's licence. It quickly backed away from this unnecessary position, but not before insisting on a mandatory registration system (something which, to its credit, CAAS rejected);¹³² failure to register any drone greater than 250g could result in a jail term of three years and a fine of US\$250,000. There was again backlash, first regarding the sheer disproportionality of the sanction for failure to register, and secondly regarding the potential breach of data

131 Lester Hio, “Up to 30% of Drone Permit Applications Rejected Last Month” *The Straits Times* (15 February 2015). Cf Amanda Lee, “700 Applications to Fly Drones Received” *Today* (4 February 2016).

132 Lester Hio, “No Need for Drone Hobbyists Here to Register Their Devices: CAAS” *The Straits Times* (4 February 2016).

protection from the searchability of the registration database. FAA then tried to design a set of compulsory restrictions (such as those relating to altitude, line-of-sight and proximity to people) for flying, but realised that it was impossible to find a sensible consensus. Finally, FAA attempted to distinguish between recreational and commercial use, stating that for the latter, the pilot needed to pass an aeronautical knowledge test and be vetted by the Transportation Safety Administration. However, waivers for both commercial users and recreational users (to fly beyond the default prohibitions) could be applied for online in a hassle-free way, and naturally, many users took the route of waivers. The state of the law is still in flux at the moment, but it seems that the US is on the trajectory towards greater freedom, rather than greater restriction. Ultimately, the regulators realised that drone imaging, especially when carried out by small consumer drones, was (and still is) largely a harmless activity, and that all of the initial attempts to over-regulate only had the effect of shutting down the activity altogether. Further, it is also likely that FAA recognised the paradox that many regulators worldwide often fail to even realise: a person who wishes to fly for commercial gain is somehow required to obtain a permit, but why? This does not happen to non-aerial imagers. Market forces would dictate that only those with a credible flying record would be hired, but at the same time, the regulators believe that obtaining a permit would improve the safety of commercial fliers. In the final analysis, this is just another example of how the requirement of a permit meets no particular concern and will just be seen as, even if it was not intended to be, another government revenue stream.

36 Going forward, Singapore is confronted with two choices, and these would be informed by the underlying philosophy adopted. If the philosophy is that drones and drone imaging are inherently dangerous and yield little benefit, then the system for permits and permissions should be as oppressive as possible so that, in effect, only the professionals and government agencies would end up utilising drones. As mentioned, it is not just CAAS that a user has to go through in seeking permits and permissions – for instance, would a CAAS permit trump an NParks ban on flying drones in their parks? If the philosophy is that drones and drone imaging can be used sensibly even by recreational users with tolerable risks and that there is much to be explored with this technology, then not only should the rules for flying be more precise and nuanced so that users can better regulate their conduct and the gradation of risks are better accounted for, a system for permits and permissions should be the exception rather than the norm;¹³³ alternatively, the process for seeking exemptions or waivers

133 Based on what has been covered in this article, a tentative proposal of what a more nuanced set of regulations might look like is presented in Annex 4 below.

should be made affordable, expedient and flexible as regards aspects of the flight that may be relaxed (such as height limits, night flights and first-person-view supplemented by spotters) depending on the specifications of the drone in question (such as weight, imaging power and redundancies). At the same time, it might also be worth looking at whether the prescribed sentencing ranges are unduly harsh and whether they can be calibrated based on a broader range of factors rather than just categorisation of offence alone.

IV. Recapitulation and concluding thoughts

37 In summary, the author has attempted to demonstrate the following points in this article:

(a) Certain prohibitions declared by CAAS, such as flying over roads and crowds, night flights and sole reliance on first-person-view, find no obvious legal basis and may be interpreted as non-enforceable guidelines.

(b) In any event, the general duty not to endanger the safety of persons, aircraft or property, while flexible, overly subsumes too many important limits that users may need clarity for to regulate their behaviour, such as distance, speed and proximity to persons and property. At the same time, the altitude restriction of 200ft is strict. In redesigning the law based on these various limits, variables such as the weight and the type of drones should be duly factored in.

(c) For the foreseeable future, it is unlikely that drones would be the preferred tools for harassment, breach of data protection or surveillance. As for the right to privacy, even assuming it exists, the main areas of contention are likely to be about the airspace that a homeowner owns, and the balancing of rights. There is also a separate question of whether flight data, while useful for investigations if there are incidents, should be protected.

(d) A system of permits and permissions should not be oppressive by default. Instead, it should complement the existing regulatory framework in a positive way. But to do so, the framework has to be better designed in terms of precision and nuance to facilitate proportionate regulation.

38 With only around 700 square kilometres of land, Singapore is one of the smallest countries in the world. With a population of more than five million people, the island city-state is also one of the most densely populated, where high-rise buildings and large congregations of people are the norm rather than the exception in the urbanised areas.

And with one of the world's highest rates of internet and mobile internet penetration, wireless interference is everywhere in Singapore. From this perspective alone, it may not seem to make sense to take an overly permissive approach with respect to the regulation of drones, considering too that Singapore is an aviation hub (complete with several military airbases) and there are many competing uses for its limited airspace on a daily basis. After all, what can possibly be worse than an aviation incident in a country as densely packed and littered with skyscrapers as Singapore?

39 Fears of things flying in the sky, however, have to be grounded in reality, coupled with the clear cognisance of the drawbacks of shutting down a technological tool altogether and destroying important innovation and forms of expression. For instance, despite initial attempts by the media at fearmongering and sensationalising, numerous scientific studies and experiments have shown that most consumer drones do not actually pose any real risks to aircraft.¹³⁴ This is not to say that the 5km buffer zone for aerodromes should be lifted – but the danger presented by drones, notwithstanding the extremely low odds, is not so much direct impact with the aircraft; instead, it is the tremendous and possibly dangerous inconvenience when runways are blocked by stray drones or when aircraft have to take evasive measures at the last minute. But the point that remains is that regulations need to make sense and be flexible where necessary, and should not be a result of either a blind adoption of rules from other places or an unthinking continuation of rules that had applied to different types of aerial vehicles. Singapore's regulatory framework for recreational drone users is a self-contradiction in this sense, because the existing rules are unduly restrictive (breaches of which result in severe penalties), and the gaps highlighted in this article create an uncertainty that does not help make the activity a safer one. When the next phase of review of the regulatory framework comes about, it would be prudent to extensively consult all stakeholders – this article has only scratched the surface as to what is round the corner.

134 See for instance BBC, "Small Drone Risks to Aircraft 'Minimal'", <<http://www.bbc.com/news/technology-33008257>> (accessed 5 December 2016); Digital Trends, "New Research Suggests the FAA Exaggerates the Threat that Drones Pose to Planes" <<http://www.digitaltrends.com/cool-tech/researchers-say-faa-overestimating-small-drone-risk/>> (accessed 5 December 2016).



Annex 4: Tentative Proposal of Amended Regulations for Recreational and Commercial Users of Drones Up to 5kg

Nett weight of drone used in aerial imaging	Height limit without permit	Speed limit without permit	Distance limit without permit	Line-of-sight without permit	Night flying without permit	Flying over crowds (not including major events)	Flying over busy roads	Proximity to persons (not including pilot) and buildings
Below 1kg	300ft	70km/h	1km	No need	Up till sunset	Okay	Need permit	20m apart from taking off and landing
1-3kg	400ft	60km/h	800m	No need	Up till sunset	Need permit	Need permit	30m apart from taking off and landing
3-5kg	400ft; 500ft if there is battery or propeller redundancy	50km/h	600m	No need, but spotter required	Up till sunset	Need permit	Need permit	50m apart from taking off and landing

Note 1: The 5km-proximity to airbase rule is unaffected, though it may be worth considering if small drones should be permitted to fly within a shorter radius, perhaps with a lower height limit.

Note 2: The proximity limits to prohibited, protected and restricted areas should also be clarified – for instance, while one clearly cannot fly over any such areas, can one fly near such areas (and if so how near)?