Regulatory Impact on the Commercial Use of Unmanned Aircraft and the Future of the Commercial Drone Industry: the Singapore Experience

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Abstract
With the increasing popularity in using civilian unmanned aircraft for commercial and recreational purposes, there is a corresponding need for laws to keep pace with new technology in order to regulate their operation and integrate them safely into Singapore airspace. This paper will discuss the impact of such regulation on the commercial use of drones and the future of the commercial drone industry in Singapore. It will also suggest areas where the regulatory framework could be strengthened taking into consideration other drone regulations in the region and beyond.

1. Introduction
"Unmanned aircraft" (UA) have long been associated with military drones dispatched to strike targets or conduct surveillance on foreign soil. Beyond their military applications, drones have numerous civilian uses such as for law enforcement and patrolling, providing ambulance services, disaster relief, atmosphere sampling, traffic control, crop dusting, news broadcasts, search and rescue, scientific research, nuclear radiation detecting, flood monitoring, mapping of quake-hit areas, news gathering, land surveying, delivery of post, packages and goods or simply for recreational purposes. The potential for commercial applications is immense. Futuristic videos show the Burrito Bomber dropping burritos by parachute, the Domicoptercarrying Domino’s pizzas over the English countryside and an RC copter returning customers’ dry-cleaned shirts. Amazon has announced plans for its Prime Air programme, a drones-based package delivery and the Crocs Footware Company in Tokyo shows drones picking up pairs of shoes. Businesses in Singapore are also leveraging on drone capabilities. A local film producer has used drones for filming movies and a local bar-restaurant, Timbre, is gearing up for drone waiters to transport food from the kitchen to the restaurant floor. This will ease manpower shortages in Singapore and increase productivity in the food and beverage industry. In aerial surveys and mapping, advertising, filming and commercial photography, drones are found to be more cost-effective than helicopters and planes. In Singapore, there is growing public interest in civilian unmanned aircraft for recreational and commercial purposes. There is also business interest in growing the commercial unmanned aerial system industry here. In response to these developments and prompted by twenty safety incidents involving drones, the Civil Aviation Authority of Singapore (CAAS) undertook a review of the regulatory framework for unmanned aircraft and their operation in Singapore airspace.

1 Commonly known as drones which are pilotless aircraft controlled autonomously by computers or by remote pilots. They are also called remotely piloted aircraft (RPA) by the International Civil Aviation Organization. These terms are used to describe the aircraft itself. The term “unmanned aerial vehicle” (UAV) is being phased out. In contrast, Unmanned Aircraft System (UAS) is generally used to describe the entire operating equipment including the aircraft, the control station from where the aircraft is operated and the wireless data link. See https://en.wikipedia.org/wiki/Unmanned_aerial_vehicle
2 http://www.huffingtonpost.ca/2013/07/15/drone-use-canada_n_3597277.html
3 However, Amazon cannot fly its delivery drones under the US Federal Aviation Authority’s proposed drone laws. http://www.businessinsider.com/amazon-faa-drone-regulations-2015-2#ixzz3kHxA41UA
https://sg.search.yahoo.com/search;_ylt=AuhKP_sXX5MKnw9CdWn0jvKCG7i_?fr=yfp-t-204-s&toggle=1&fp=1&cop=mss&ei=UTF-8&p=drones%20serving%20food%20in%20Singapore%20restaurant
6 Similarly, Japan was prompted to strengthen her drone legislation after a camera-equipped drone carrying trace amounts of radioactive cesium landed on the roof of the Prime Minister’s Office. It was identified as the same type of drone that landed on the lawns of the White House: http://www.bloomberg.com/news/articles/2015-04-22/drone-lands-on-roof-of-japanese-prime-minister-s-office-in-tokyo
and the Unmanned Aircraft (Public Safety and Security) Act ("the Unmanned Aircraft Act") was enacted.

2. Current regulatory framework: Direct UA legislation
The growing popularity in flying unmanned aircraft raises public safety, security and privacy concerns. A drone may pose a hazard to air navigation, and injure people on the ground or damage property in the course of its flight or when it malfunctions. The Singapore regulatory framework therefore seeks to integrate drones into airspace by addressing safety and security risks posed by unmanned aircraft activities. It does not address privacy issues.

At present, drones need not be registered or require a certificate of airworthiness before they can operate. Neither is pilot qualification needed. Section 16 of the Air Navigation Act requires the licensing of aircraft for commercial purposes, but this is presumably not required of UAs as "unmanned aircraft" is separately defined from "aircraft". However, certain UA operations require permits.

There are a handful of provisions in the Unmanned Aircraft Act regulating commercial drones. What the new regulatory framework requires is a permit to fly a drone that weighs more than 7 kg. Those weighing less than 7 kg ("small unmanned aircraft"), usually recreational drones or those used for research, do not need a permit. However, two permits are needed for drones used for commercial activities or specialised services, regardless of their weight. They are: a UA operator permit and an activity permit. Thus, even small drones weighing less than 7 kg that are usually used for commercial photography or general filming need the permits. Commercial activities are defined to include aerial photography, advertising, construction, delivering anything in the course of business (e.g. dry-cleaned shirts, pizzas, packages for which a permit must be obtained) and display performances. Specialised services are defined to include services for agriculture, construction, surveying, flying display performances and aerial advertising. Permits are not required if a drone is flown indoors for the purpose of constructing or testing. Similarly, no permits are needed in the case of a small drone whether operated outdoors or indoors on an experimental site for that aircraft. However, both permits are required for operating a small unmanned aircraft outdoors, or indoors in premises (that are not a private residence or an experimental site for that aircraft) in the course of a business. This includes small drone waiters or those used for advertising, farming or other agricultural activity.

7 It amends the Air Navigation Act and Public Order Act. It took effect from 1 June 2015 and will be enforced under existing laws such as the Penal Code and Protection from Harassment Act 2014.
8 “Unmanned aircraft” means an aircraft that may be flown or used without any individual on board the aircraft to operate it.
9 “Aircraft” means any machine that can derive support in the atmosphere from the reactions of the air otherwise than by the reactions of the air against the surface of the earth.
10 “Large unmanned aircraft” means an unmanned aircraft with a total mass exceeding 7 kg. “Total mass” means the mass of the aircraft including the mass of any other thing that may be attached to the aircraft during its operation, such as any payload, battery or fuel.
11 “Small unmanned aircraft” means an unmanned aircraft that is not a large unmanned aircraft.
12 No permit is required if the UA is flown at an altitude not exceeding 200 feet above mean sea level and outside of any restricted area or danger area or any area within 5 km of any aerodrome: 72D Air Navigation Order. But operators should refer to CAAS's Advisory on the Safe and Responsible Operation of Unmanned Aircraft: FLY IT SAFE! In Japan, smaller drones will be exempt from the regulations but their operators will be instructed under guidelines issued by private industry groups: http://ajw.asahi.com/article/behind_news/social_affairs/AJ201506030035
13 Paragraph 72D Air Navigation Order
14 Paragraph 72F Air Navigation Order
15 Paragraph 72F Air Navigation Order
surveying or inspecting any site or building, or delivering anything in the course of business. Both permits are also required for conducting training or organising classes for reward on the use or operation of drones.

A permit from the CAAS must be obtained to fly drones within 5 km of an aerodrome, or at an altitude higher than 200 feet (61 m) above mean sea level when outside 5 km of an aerodrome. Furthermore, when operating drones either indoors or outdoors, any person, including a business operator, owes a duty not to endanger the safety of any person, aircraft or property. The penalty for any infringement is a fine not exceeding $20,000. In the case of a second or subsequent conviction, the fine is up to $40,000 or imprisonment not exceeding 15 months or both. More severe penalties are imposed by s.10 of the Air Navigation Act, on the pilot and owner for flying aircraft in a manner which causes unnecessary danger to any person or property on land or water. The penalty for any infringement is a fine not exceeding $100,000 or imprisonment up to 5 years or both. Section 10 applies to aircraft but presumably not to unmanned aircraft, as explained above.

With regard to the application for permits, CAAS has simplified the process by launching a one-stop online portal to facilitate applications. The average processing time for a permit takes about two weeks. CAAS has stated it will grant an operator permit if the applicant is able to ensure safe operation of the UA, taking into account the applicant’s organisational set-up, competency of the UA operator, procedures to manage safety including the conduct of safety risk assessments, and the airworthiness of the UA. The permit is valid for up to one year. CAAS will grant an activity permit for a single activity or a block of repeated activities to be carried out by a UA at a specific area of operation, and which are of specific operational profiles and conditions.

A discharge permit is required for discharging or dropping anything (whether gaseous, liquid or solid) from a drone that is flown indoors or outdoors at any height. This applies to a business using drones to drop food by parachute, or deliver parcels, packages, post or other goods. The penalty for any infringement is a fine not exceeding $20,000. It is a defence to show that the operator did not intentionally cause the discharge and the discharge was not due to any reasonable want of care on his part.

There are restrictions on flying over protected areas. A permit from a competent security officer is required to fly at any height over any protected area. The penalty for any infringement is a fine up to $20,000 or imprisonment not exceeding 12 months or both. However, it is a defence if the operator can show that the flight over the protected area was not intentional or was not due to a lack of reasonable care on his part e.g. if the drone was blown off course into the protected area.

A permit is also required for taking photographs (including videoing and live-streaming) of a protected area from a UA. The penalty for any infringement is a fine up to $20,000 or imprisonment not exceeding 12 months or both.

A prohibited item permit is needed for UAs to enter special event areas that are declared by the Ministry of Home Affairs under the Public Order Act. During the closing ceremony of the 28th South East Asian Games 2015, a man was seen taking photographs of the fireworks from a UA flying

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16 These are illustrations provided under paragraph 72F Air Navigation Order
17 Including a military aerodrome under the Air Navigation Order
18 Paragraph 72E Air Navigation Order
20 S.7C Air Navigation Act
21 Security-sensitive locations gazetted as such and their immediate vicinity defined by a lateral limit of 150m from the perimeter of a designated location. Examples of such locations are the Istana, Parliament House, Supreme Court, Jurong Island, and military camps and bases. The specific locations of the protected areas are published in the Government Gazette and updated on CAAS’ OneMap portal
23 S.7 Air Navigation Act
24 E.g. the venues of the Southeast Asian Games 2015
near the National Stadium (designated a special event area). He did not have the relevant permit and was issued with a stern police warning. Apart from prohibited areas and special event venues, there is no prohibition against drones flying over housing estates and public places e.g. parks, beaches and roads, unlike the position in some other jurisdictions.

A permit is needed if the radio frequencies and power limits used for operating the unmanned aircraft do not comply with the Infocomm Development Authority’s guidelines on radio frequencies and power limits for short range devices. Turning to absolute prohibitions, drone operators cannot fly over Restricted or Danger Areas declared by the CAAS for aviation and/or public safety reasons. In addition, operators cannot fly drones carrying weapons or hazardous materials such as bio-chemical or radioactive materials indoors or at any height over any area in Singapore. This is intended to address drones which are armed for criminal or terrorist activities. The prohibition includes drones carrying dangerous fireworkssuch as firecrackers, rocket fireworks and sandcrackers. Severe penalties are imposed for any infringement: a fine of up to $100,000 or imprisonment not exceeding 5 years or both. It is a defence if the operator can show that he did not know that the UA carried prohibited item and he could not reasonably have known that it did. The Act, however, does not prescribe preventive measures that can be taken to check whether drones are carrying dangerous or hazardous substances. It may be too late once the rogue drone has taken off and is in flight even though law enforcers have powers of interception. However, there is no power to shoot down a rogue drone if it refuses to land or is out of control and endangering public safety. Powers of interception allow authorised personnel e.g. a police officer, to assume control of a UA to fly it, end its flight or land it. According to the Singapore Transport Minister, “how this will be done will depend on the circumstances, taking into consideration the need to ensure public safety”. Thus, where a drone is operated in a manner that contravenes the regulations or poses a serious and an imminent risk to public safety such as flying too low in a crowded place or too high into the flight path of scheduled airlines, the drone operator may be asked to end the flight, or land it safely in the fastest practicable way or fly the UA in the manner specified by the authorised officer suchas flying at a lower altitude. The penalty for contravening the directions of the authorised personnel is a fine not exceeding $20,000 or imprisonment not exceeding 12 months or both.

3. Other Singapore laws affecting liability for commercial UAs

Direct UA legislation affects the operation of drones in terms of permits and strict no-fly zones. But when accidents or mishaps occur involving UAs, these will give rise to potential civil suits under the general law of Singapore. Such claims are yet to be tested in the Singapore courts. When such novel issues arise, the judicial approach is to build on current legal principles in order to resolve the dispute, and in the course of which to develop the law relating to drone liabilities.

3.1 Tort of negligence

Negligence law may affect the drone operator as well as the commercial drone industry. A drone manufacturer may be held liable for faulty designs, manufacturing defects or inadequate instructions or warnings. In the case of drone operators, increased recreational and commercial drone activity may lead to mishaps and potential civil suits for personal injuries and property damage. For instance, a drone may malfunction and drop objects it is carrying or crash into spectators, buildings or other

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26 It established a temporary Restricted Area under the Air Navigation Order to ensure the safety of aircraft flying at low levels in the Jubilee Weekend aerial displays and in the National Day Parade 2015 aerial displays. Issued May 28 May 2015
27 The drone landing on the roof of the Japanese Prime Minister’s office was found to carry trace amounts of radioactive cesium
29 S.29G of the Unmanned Aircraft Act; s.32A Public Order Act
structures. Recently, a drone flew out of control and crashed into a photographer’s face at a TGI Fridays outlet in New York.\footnote{http://www.brooklyndaily.com/stories/2014/50/bn-drone-disaster-at-tgifridays-2014-12-12-bk_2014_50.html}

Who are liable for the personal injuries or property damage caused by falling drones? There is a dearth of case law. The victim, like any other plaintiff in a negligence suit, must prove all of the following: (a) the operator owed a duty of reasonable care to the victim when operating the drone. In determining this duty, Singapore law considers questions of factual foreseeability, proximity and policy considerations,\footnote{Spadence Engineering (S) Pte Ltd v Defence Science & Technology Agency (2007) SLR (R) 100, Court of Appeal} (b) the operator was in breach of that duty by failing to exercise reasonable care or take the necessary safety measures when flying the drone, (c) the breach caused the loss and (d) the type of loss was not too remote being a reasonably foreseeable consequence of the breach. A relevant case is\cite{Rowe et al v Striker et al, Rowe v Striker 2008 Ohio 4654, Ohio Court of Appeals, 9th Appellate District}. In that case, Striker was flying his giant model airplane when he lost control. He shouted out a warning that he had lost control. Rowe stated in a statement to an insurance adjuster that he observed the plane until it disappeared over some nearby trees. Assuming it would crash into the trees, he stopped paying attention to it. Such evidence was only presented by way of a "transcript" of Rowe’s purported statements to the insurance adjuster regarding the incident. However, the plane made a turn and struck Rowe from behind, nearly severing his right leg. The force hurled him to the ground causing his shoulder to be impaled on a tent stake. Rowe brought an action against Striker alleging that he was negligent and reckless in his construction and operation of the airplane. In his defence, Striker raised \textit{inter alia} contributory negligence.

The trial judge dismissed Rowe's complaint. He held that after Striker shouted the warning, any negligence on his part was absolved. Thereafter, Rowe came under a duty to take precautionary measures to protect himself. In failing to do so, he was negligent and it was his negligence that was the proximate cause of his own injuries. Rowe objected to the admissibility of the transcript statement and to the trial judge’s consideration of it. The appellate court sustained this objection on technical grounds\footnote{In this case, a copy of a transcript, "unaccompanied by a certification or notarization and supported solely by an affidavit of counsel showing no indicia of personal knowledge" as to its accuracy, does not comply with the evidentiary requirements of Civ.R. 56.} and reversed the judgment of the trial court. It is submitted that even if the transcript evidence was admissible, Rowe’s conduct would only have amounted to contributory negligence. It is difficult to see how his conduct broke the chain of causation.

In a negligence suit, it may be difficult for the plaintiff to prove a breach of duty on the part of the defendant in the absence of knowledge as to how the accident happened. In this case, the plaintiff may raise the maxim \textit{res ipsa loquitur} (the facts speak for themselves). The court will then decide whether to infer negligence from the circumstances. It was invoked in an early case where a flour barrel fell from a second storey and struck the plaintiff in the head.\footnote{Byrne v Boodle, 159 Eng. Rep. 299; (1863) 2 H&C 722} The court held that the plaintiff need not prove that someone had acted negligently since the accident was such that a barrel would not have fallen in the ordinary course of things without negligence. The maxim may be invoked by the victim of a malfunctioning drone if he can show that the drone was under the control of the drone operator; the accident was not of a type which would occur without negligence and the cause of the accident was unknown. Without having to establish difficult issues of fault, drone victims may recover compensation more efficiently.

\subsection*{3.1.1 Defences}

Certain defences available to a tortfeasor may be available in civil claims involving drones. A negligent drone operator may plead contributory negligence where the victim’s conduct has at the same time contributed to the extent of his loss where for example, he did not take reasonable care for his own safety. If successfully pleaded, the victim’s damages will be reduced to such extent that the court thinks just and equitable having regard to the victim’s fault in contributing to the loss.

A second defence is \textit{volenti non fit injuria}. The defence of voluntarily assuming the risk of injury has been raised against spectators and other injured competitors in sporting events. Can the \textit{volenti} defence
be raised against persons who are injured by drones going out of control? Were the victims volens: did they have full knowledge of and voluntarily consent to the dangers posed by the flying drones? This is a novel issue. Whether the defence is applicable is dependent on a factual inquiry.

Two other possible defences are: (a) act of God and (b) inevitable accident. Act of God may be pleaded where the accident is unforeseeable and is caused by natural causes without human intervention such as a force majeure event that was unforeseeable and beyond the defendant’s control. Although a novel issue, the court may find the defence applicable on the facts of the case.

The defence of inevitable accident was successfully invoked in the context of two ships colliding in dense fog where the defendant “could not possibly prevent [the accident] by the exercise of ordinary care, caution, skill”. Whether this can be extended to colliding drones in similar weather conditions is yet to be tested in the courts.

Finally, what is the effect of exempting liability for damage caused by defective drones, where the exemption has been brought to the reasonable attention of the victims? The effect of this is clear. Under s.2(1) of the Unfair Contract Terms Act, a contract term or notice excluding or limiting liability for death or personal injury is void. With regard to other damage e.g. property damage or economic loss, the contract term or notice will be effective insofar as it satisfies the test of reasonableness.

3.2 Strict liability

Negligence suits are notoriously lengthy and costly. They often involve expert evidence, particularly where technical issues are involved. The cause of the accident could range from human error, software or design defects in the UA to battery depletion. Given that negligence is difficult to prove and given the dangerous nature of drone technology and the potential harm posed by malfunctioning drones, should strict liability be imposed? Strict liability is not commonly imposed under common law or Singapore law. There should be sound policy reasons before imposing strict liability on drone manufacturers for manufacturing defects and on the owner and operator for injury to person or damage to property caused by the mishandling of the drone or by something dropping from it. The defendants will be strictly liable without proof of negligence, wilful act, neglect or default. This would exclude arguments by the defendants that they had undertaken reasonable safety measures, or that the incident was due to engine malfunction, manufacturing defects, weather conditions or unforeseeable events e.g. colliding with a bird or other airborne object. As drones become commonplace and the danger they pose increases, policy considerations may dictate that strict liability be imposed for damage done by drones. In fact, section 9(2) of the Air Navigation Act already imposes strict liability where material damage or loss is caused by an aircraft in flight, taking off or landing or by any object falling from any such aircraft to any person or property on land or water. In this case, damages are recoverable without proof of negligence or intention or other cause of action as if the loss or damage had been caused by the wilful act, neglect or default of the owner of the aircraft. It is submitted that if deemed necessary, the section 9(2) strict liability should be extended to UAs.

3.3 Trespass and nuisance

Operators of drones flying above the airspace of private property may face potential liability for the tort of trespass or nuisance. Trespass is defined as an unjustifiable interference with the possession of land or with the airspace above it. Trespass is actionable per se, without proof of actual damage. The tort of nuisance is distinguishable as an indirect interference with land or its immediate airspace and proof of damage is required. In the present context, the plaintiff must show that the noise or dust created by the drone or its low overflight constitutes "a substantial and unreasonable interference" with his "use and enjoyment" of land. Hence, intermittent or temporary nuisance may not be unreasonable and actionable in nuisance.

Trespass by aircraft is governed by the Air Navigation Act. Section 9 (1) exempts aircraft that flies at a reasonable height from trespass or nuisance actions but does not specify the permissible altitude. Two issues arise with regard to unmanned aircraft. First, as seen above, "unmanned aircraft" are separately defined from “aircraft”. Second, drones fly at lower altitudes than manned aircraft. What is a

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35 The Marpesia (1872) LR4PC 212; 17 ER 387, Privy Council where two ships collided in dense fog.
reasonable height for a drone to fly in order to come within the specified exemption. For other purposes, a drone flying higher than 200 feet must obtain a permit from CAAS. In comparison, the US Federal Aviation Authority (FAA) in a 9 June 1981 Advisory Circular suggested that model airplanes fly below 400 feet. This was adopted in specific drone legislation in Oregon, for instance, prohibiting flying below 400 feet of the owner’s property. Clarification of these uncertainties will enhance Singapore’s drone regulatory framework.

Assuming that a low flying drone commits trespass, does the land owner have the right to stop it flying? Only authorised officers have the statutory right to stop a drone in flight and not private property owners. Under the general law, a land owner can employ self-help remedies to abate trespass, such as using reasonable and proportionate force to eject trespassers from the land, but certainly shooting down a drone would be out of all proportion to the trespass. Moreover, firing arms for this purpose may constitute a crime under the Arms Offences Act.

Trespass and nuisance can also be crimes. Section 441 of the Penal Code penalises trespass by a person while s.21 of the Miscellaneous Offences (Public Order and Nuisance) Act penalises willful trespass on property by a person. Neither section contemplates trespass by remotely controlled drones. The possibility of a drone landing on a road or highway is real. When it does so, it interferes with the public right of way and creates a danger to road users. Existing legislation relates to obstruction or interference caused by vehicles. The definition of “vehicle” does not yet include “unmanned vehicles”. The current regulation penalises persons who trespass at aerodromes, not unmanned vehicles. The law needs to catch up with new technology in view of the danger created to other aircraft when drones land on airport runways. Thus, when a recreational drone landed on the runway at the Kuala Lumpur International Airport (a controlled airspace and 1.5 nautical miles within an airport) it caused serious security and safety concerns and resulted in a warning issued by the Department of Civil Aviation prohibiting the flying of UAs in the vicinity of airports. Similarly, a low-flying drone at Beijing Capital International Airport forced two passenger planes to change course and more than 10 flights to be delayed. It turned out to be a company conducting an aerial survey near the airport. Four people were detained for endangering public security.

3.4 Privacy

The growing popularity of drones raises privacy concerns due to their invasiveness and unique attributes. Privacy rights are not protected under the Singapore Constitution and there is no specific tort of privacy or comprehensive privacy legislation in Singapore. Although it is a criminal offence to use drones to stalk or harass people, it is unlikely that commercial drones are intentionally used for this purpose.

3.5 Personal Data Protection

In the absence of privacy provisions in the Unmanned Aircraft Act, reliance may be placed on Singapore’s Personal Data Protection Act 2012 (PDPA). Information-collecting drones raise personal data protection issues. If a drone is fitted with a camera or is utilised to collect personal data off mobile phones, its use may fall within the PDPA. This is somewhat similar to the Google Street View Project using street cameras taking photographs from an elevated position. Google had to censor the photographs by blurring the faces of passers-by and car number plates. More intrusive than street cameras, drones have unique vantage points and the capability to collect massive amounts of data.

36 S.13 Miscellaneous Offences (Public Order and Nuisance) Act
37 S.8E Air Navigation Act
38 The Straits Times, May 14 2015
40 Although there are specific privacy related legislation e.g. Banking Act, Officials Secrets Act, Electronic Transactions Act, Computer Misuse and Cybersecurity Act etc. Privacy may also be protected by an action for breach of confidence
41 Under the Protection from Harassment Act 2014
42 Defined as data, whether true or not, about an individual who can be identified: (a) from that data, or (b) from that data and other information to which the organization is likely to have access.
without the knowledge of the persons whose personal data is being collected by unknown or anonymous drone operators. Under the PDPA, businesses are allowed to exploit consumer data (subject to data protection rights) for such purposes as are reasonably appropriate in the circumstances. Accordingly, commercial drone operators seeking to collect personal information must make known their privacy policies and comply with the PDPA in relation to: (a) notification of purpose and consent for collection, use and disclosure, (b) care, security, retention, access, accuracy and correction and (e) transfers of data out of Singapore. Thus, an operator taking photographs from a drone of identifiable individuals in the course of business will be required to obtain consent. Communication may be through social media or by other means.

4. Regulatory Impact on the commercial use of drones

Does Singapore's drone-specific legislation unduly restrict the commercial application of drones? The Unmanned Aircraft Act is a baseregulatory framework that provides oversight of UA activities in the interests of public safety and security. Most of the provisions prescribe strict no-fly zones which restrict the airspace for drones and may limit commercial drone usage. Singapore is a small, densely populated city-state with a congested airspace and ground. Notwithstanding air-space limitations, by having a light-touch regulatory framework, it allows for the commercial application of drones with the necessary permits. This is in line with Singapore's policy of striking a "judicious balance" between security and allowing drone operators to experiment and innovate - the so-called "challenge and dilemma" that Singapore faces. Although the regulatory framework seeks to integrate drones with the national airspace, integrating them into a busy and limited airspace is challenging. But by not hampering innovation and the use of technology, it encourages the development of a drone technology industry and facilitates companies to put drones to innovative commercial applications, thereby benefitting from the capabilities of drone technology.

5. Future regulation of drones and the commercial drone industry

As commercial drones become commonplace and as Singapore develops a commercial drone industry, a more robust regulatory framework may be essential in the future. Privacy concerns should be addressed and detailed rules provided to regulate data-collecting drones, camera-equipped drones and those used for aerial work purposes. While these uses must comply with the PDPA, its provisions are of general application and not drone-specific enough. The unique attributes of drones and their intrusiveness pose privacy challenges, particularly where some 85% of Singaporeans live in high-rise public housing. Although photography, videos and live streaming over protected areas are prohibited, there is no specific rule against drones hovering near winders nor is there any restriction on how high or how far they can fly within the vicinity of high-rise public housing. The requirement for a CAAS permit to fly drones at an altitude higher than 200 feet (61 m) above mean sea level when outside 5 km of an aerodrome is unlikely to prevent privacy intrusions by low-flying drones. Furthermore, there are no guidelines issued by the Singapore Personal Data Commission (PDPC) to facilitate compliance by commercial drones with data protection legislation. Singapore’s counterparts in other jurisdictions have already issued guidelines: in Hong Kong, the United Kingdom and the Article 29 European Working Party. Some of their recommendations can

\[43\] Proposed new laws in Thailand require a permit for businesses to fly drones with cameras attached for aerial photography, film making and news media use: http://englishnews.thaipbs.or.th/flying-personal-drones-come-tightened-control-soon

\[44\] The Hong Kong Privacy Commissioner for Personal Data has issued Guidance on CCTV Surveillance and Use of Drones (March 2015)

\[45\] The UK Information Commissioner’s Office has recommended that users of drones with cameras should operate them in a responsible way to respect the privacy of others: A data protection code of practice for surveillance cameras and personal information: 7.3 Unmanned Aerial Systems (UAS) https://ico.org.uk/for-the-public/drones/

\[46\] The Article 29 European Working Party's Opinion 01/2015 on Privacy and Data Protection Issues relating to the Utilisation of Drones (WP 29) issued specific guidelines after it identified the risks to data protection and privacy
be usefully adopted to strengthen Singapore’s UA regulatory framework and facilitate the use of commercial drones by indicating what their operators can and cannot do. They include the following:

(a) The Personal Data Protection Commission (PDPC) should draw up codes of conduct for drone users to address data protection concerns and the responsible use of drones. Co-operation between policy makers and the CAAS and the PDPC would be helpful in integrating the various UA requirements.

(b) Drone manufacturers should provide sufficient information with the packaging relating to the potential intrusiveness and maps showing permitted use space. Manufacturers as well as operators should embed privacy friendly design choices and privacy friendly defaults as part of a privacy by design approach e.g. devices that have restricted vision so that its focus is only in one place.

(c) Drone users should be reminded of the need to respect privacy and use drones responsibly. They should comply with the purpose limitation, record only essential personal data and secure such data collected e.g. by using encryption, and by deleting or anonymising personal data after it is no longer necessary. Drone users should let individuals know before collecting personal data through a multi-channel approach, including written event information, use of social media, public displays, newspapers or leaflets and on the drone operator website or by using flashing lights to indicate that recording is taking place. Drone users should also plan their flight paths to prevent flying too close to people or property and not hover outside windows. They should also keep their drones in view. Finally, drone users should undertake privacy impact assessments to consider how a drone may impact the privacy of others, given the potential for cameras to capture large numbers of individuals from a significant height. A privacy impact assessment should be made even though it is not required under the PDPA.

A more robust UA regulatory framework should contain more detailed rules on the operation of the UA and public safety, taking into consideration Singapore’s dense population and limited airspace. Apart from the need for commercial drone users to obtain specific CAAS authorisation and permits, the new rules should address the operation of the UA itself: certificate of airworthiness, and submitting an operating manual for approval without the need to seek further CAAS approval. Besides prohibitions, restrictions and permits, registration and tracking of UAs should be considered as more drones hit Singapore’s busy airspace. In view of this, there should be restrictions on flying in congested areas or in proximity to people and property.

47 IN Malaysia, UAs over 20 kg require a certificate of airworthiness or permit to fly issued by the Department of Civil Aviation.

48 The Civil Aviation Department of Hong Kong has issued detailed rules on Operations of Unmanned Aircraft Systems for non-recreational drones regardless of size and weight. One of the rules prohibits flying within 50 metres of any person, vessel, vehicle or structure. During take-off and landing, it cannot come within 30 metres of any person except the operator.

49 In Japan, drones are prohibited in all 81 of Tokyo’s public parks and gardens.
drones within sight of the operator and not posing a threat to other aircraft, people or private property, and securing the permission of the property owner before flying over his property. A stronger framework should also address pilot qualifications and training: a minimum age, demonstrating pilot competence by passing an initial knowledge test and retesting every few years, obtaining a drone operator’s certificate or even obtaining a private pilot’s licence (but not as stringent as getting a civilian pilot’s licence), taking courses at flight schools for flying commercial drones, and a current medical certificate of fitness to operate drones.

These proposals are already part and parcel of drone regulatory frameworks in other countries. To what extent will the regulatory framework affect the development of a commercial drone industry in Singapore? The regulations allow for drone research and testing without having to obtain a permit. This facilitates the development of the industry and prevents drone research from being moved out of the country. A case in point is Amazon. It tests its drones in the UK because US regulations restrict drone usage outdoors. It has threatened to move more of its drone research outside the US if it is not allowed to do more testing outside. Although technologically advanced, a big drawback for the development of a drone industry in Singapore is the shortage of skilled labour and limited airspace and ground.

It is said that the lack of an international regulatory framework on drones hampers the development and expansion of the civilian drone industry and creates uncertainty as to what drone operators can and cannot do. For a start, we have Article 8 of the Convention on International Civil Aviation, also known as the Chicago Convention 1944. It prohibits the flying of unmanned aircraft over the territory of a Contracting State without special authorisation by that State. This ensures the safety of national airspace from unauthorised drones. Mention must also be made of the International Civil Aviation Organisation (ICAO). It has embarked on the development of international standards to regulate unmanned aircraft operations, particularly in airspace used by manned aircraft. The work covers areas such as certification of the unmanned aircraft system (UAS), competency requirements of the UAS operator/pilot, and guidance on drone operations. Singapore, a member of the ICAO Panel, by crafting her Unmanned Aircraft Act in line with international standards, has launched a basic but useful regulatory framework. However, as commercial drones become widespread, operators and industry will need a more robust framework with detailed rules and guidelines within which to operate unmanned aircraft and to grow a commercial drone industry.

50 The US Federal Aviation Administration issued proposals for new UAS regulation in February 2015. These address safety concerns and require, inter alia, that UAS be kept within the operator’s line of sight at all times while airborne and prohibits flights over crowds of people.

51 This is a requirement in Japan and also in The Civil Aviation Department of Hong Kong’s detailed rules on Operations of Unmanned Aircraft Systems for non-recreational drones.

52 In Malaysia, all UA operators must hold a Private Pilots’ License Malaysia.