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Killing New Vistas with the Over-Regulation of Recreational 'Drone' Use

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Killing New Vistas with the Over-Regulation of Recreational “Drone” Use

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Abstract: In the last few years, there has been a dramatic increase in the use of remote-controlled copters – often given the convenient but misleading epithets of unmanned aerial vehicles or “drones” – by recreational users to capture aerial photographs and videos on an unprecedented scale. Asia is no exception. The convergence of cutting-edge technological developments in gyroscopic gimbals, long-range wireless transmissions, GPS-enabled stabilisation, GPS-enabled flightpath-preprogramming, first-person-views, and compact digital imaging has led to the proliferation of affordable camera-carrying “drones” that even hobbyists can pilot with reasonable safety. Thus far, despite purported controversies there have not been any reports of serious mishaps involving the use of these rotor-propelled copters – mainly because these copters are incapable of heavy payloads and, in any event, have a series of fail-safe tools. Yet, there has been a consistent stream of public concern relating to issues of safety, privacy, and even the protection of monopolised commercial interests. Lost in the paranoid cacophony is a question that warrants proper legislative reflection: how can such tools be regulated in a way that is proportionate and sensible? There are some jurisdictions that have already tabled legislation to regulate recreational droning, while many others are planning to introduce the same, while some are relying on clearly anachronistic legislation as a stop-gap measure. Can the law keep pace with new technology, or is the challenge too formidable? How is Asia – the principal manufacturer, exporter, and user of many of these copters – responding to the situation? This paper will examine some of the laws in the region and beyond to demonstrate how the right balance between the freedom of expression and freedom to create art, and the purported competing demands of safety, privacy, and commercial interests can be struck – or not. Questions relating to the appropriate height, distance, weight, airbase-proximity, and line of sight limits; the necessity of a licensing and/or training scheme; and the supposed problems of privacy intrusion and obstruction of commercial interests will be addressed. Ultimately, however, what is needed first and foremost is a complete mind-set shift in the legislators before one goes down the path of no return.

I. Establishing the context

One will probably have read about them in the news or even seen them in action given their recent proliferation: camera-carrying “drones” flying in and around parks, beaches, neighbourhoods, and the heart of cities, producing still images and videos in a way never done before. Asia, being the principal manufacturer, exporter, and user of these devices, is at the forefront of all the action. Unfortunately, due to the perpetuation of distorted perceptions of the supposed dangers and inconveniences that these objects bring, countries around the world are beginning to take heavy legislative measures to regulate their use, including expanding the scope of anachronistic laws.

The aims of this article are threefold: first, to provide a working understanding of how this relatively new technology actually works, and preliminarily explain why some of the perceived problems with its use are largely illusory or misconceived (Part II). Secondly, to examine some of the legislative measures that some countries have used or

introduced to (in their view) solve the aforementioned problems (Part III). Thirdly, to propose what the better way forward is – solutions that no doubt may be too late for countries that have already acted hastily, but may still be considered for those which are still mulling over the appropriate course of action (Part IV, which is also where the conclusion resides).

Before proceeding further, however, it is necessary to disambiguate the terminology used in this article. When one thinks of a “drone”, one is likely to conjure up an image of an unmanned or unpiloted aerial vehicle (otherwise known as UAV) that is used for eye-in-the-sky surveillance or deadly aerial military operations – and this is really the genesis of many misperceptions concerning recreational drone photography and videography, and indeed a subject of dispute in many ongoing conversations between governments and civil and recreational users of drone technology. However, that class of vehicles does not form the subject matter of this article, as the “drones” in question here are better described as remote-controlled, multi-propeller/rotor aircraft or copters that are designed for neither surveillance nor heavy duty work but vantage capture.¹ This is not an inaccurate distinction for reasons that will be made clearer in the course of this article. Nonetheless, for convenience, the misleading epithet “drone” shall be reluctantly adopted in this article, and indulgence in this shorthand is sought.

II. Understanding the technology and debunking mythical assumptions

A. The concerns: safety, privacy, and preserving commercial monopolisation

There are essentially three broad concerns surrounding the use of drones for aerial photography and videography, commercial or otherwise. Perhaps the foremost of these concerns is safety: the image of an object of not insignificant weight dropping from the sky – whether as a result of piloting error, system malfunction, electronic interference, or adverse weather conditions – will always have a visceral effect, especially if the drone is flown over a densely populated and/or culturally valuable place. Danger may also manifest in a different way: suppose a drone flies into the path of a civilian, military, or search-and-rescue aircraft and causes it delay, or worse, somehow causes it to crash – that will be catastrophic, to say the least.² Or suppose a terrorist is able to use a drone to fly over a guarded area to carry out a bombing attack – from that perspective, important people all over the world will potentially be in grave danger at any given point, since it seems impossible to fully guard against an attack of this nature.³ Should either of the latter scenarios materialise, no one will still be waxing lyrical about the great aerial footage captured at a couple’s wedding, the documentation of new sweeping vistas opened up by hitherto unprecedented vantage points, or the cutting-edge reportage of a disaster site – but that is also why it is important to assume the correct

¹ To be clear, the recreational use of remote-controlled aircraft has taken place for quite a number of years already, mostly without controversy or incident. It is largely due to the recent appendage of digital still and video cameras – and the widespread availability of ready-made copters – that has caused the widespread paranoia.

² See for instance <http://www.straitstimes.com/news/asia/south-east-asia/story/drone-photos-aircraft-kuala-lumpur-international-airport-spark-outra>.

³ See for instance <http://edition.cnn.com/2015/02/02/politics/white-house-drone-crasher-apology/>.

mindset when conceptualising regulations in this field: liability cannot disproportionately trump rights if the dangers are more perceived than real.

Another oft-cited concern is privacy, and this ultimately stems from the surveillance characteristic often associated with drones – an image probably reinforced by pop culture and sensationalist media more than anything else. Would a drone be used voyeuristically by deviants and perverts? Would corporations, on the pretext of making deliveries or advertising (or even without such pretexts), collect private data such as patterns and vulnerabilities of their customers and potential clientele – and what would happen to these data? Or would governments abuse their executive powers to spy on people in the name of national security? Of course, privacy can also assume a quite different, more general form: that of the right to peace and tranquility. For that reason, drones have been, without consultation or contemplation, banned from national parks in countries such as the United States, purportedly to preserve the enjoyment of visitors (and the supposed safety of the animals as well).⁴

Then there is the final concern of disrupting deeply vested commercial interests. For instance, should a privately-operated drone be allowed to hover near a stadium hosting a high-profile event that is being broadcast all over the world for hundreds of millions of dollars? To use an even more specific example, would the organisers of a Formula One night race, having spent a lot of money installing blinding lights that cut out visibility from above, have had any right to prevent drones seeking different vantage points from flying near the race track?⁵ Again, it is noteworthy that with respect to all of the aforementioned concerns, people analyse the issues to the exclusion of the actual users of the drones. Do not such users have some rights to take pictures and videos to express themselves and create art – and in some cases to create news even?

B. The current state of technology of recreational imaging and videography drones

Before answering those questions, however, it will be absolutely necessary to have a working understanding of the technology in question here so as to be in a position to evaluate the laws and regulations. An appropriate reference point at this juncture will be the now-ubiquitous Inspire 1, a consumer-level photography-videography drone manufactured by the Chinese company Da-Jiang Innovations, or more popularly known as DJI.⁶ The Inspire 1 is the first iteration of the company's latest series of drones, and builds upon technology that is quite a few years old already. This is what it looks like, with its landing gear lifted (© DJI):

⁴ <http://home.nps.gov/news/release.htm?id=1601>.

⁵ <http://www.straitstimes.com/news/singapore/transport/story/curbs-flying-unmanned-aircraft-during-f1-race-20140916>.

⁶ DJI is widely considered to be the biggest manufacturer in the world today of consumer/prosumer drones for photography/videography. Its Phantom and Spreading Wings lines are also particularly popular because of their affordability and general ease of use. Another popular recreational drone-making company is Parrot, and there are also various crowdfunding projects for such products as well.



The dimensions and specifications of this particular drone give some valuable context.⁷ The Inspire 1 is 438 x 451 x 301 mm, and weighs 2.9 kg when the full set of accessories and battery are loaded. It can, in theory, achieve altitude of up to 4.5 km and has a maximum ascent and descent speed of 5 m/s and 4 m/s respectively. With a 4500 mAh LiPo battery, the maximum flight time is 18 minutes and its maximum wind resistance is rated at 10 m/s. The drone is largely made up of plastic.

As can be seen in the picture, this drone is of the rotor-powered, multi-propeller variety (a quad-copter, to be precise) that has a fixed camera and gyroscopic gimbal (this keeps the camera level on all axes and stabilised) attached at the bottom. The camera contains a 1/2.3" sensor (which is about the same as that of a mobile phone camera's sensor) that can capture 12 megapixel stills⁸ and 4K video (at 30 frames per second),⁹ and uses a prime 20 mm (35 mm equivalent) lens that has a 94 degree field of view. The drone, with a transmitting distance of up to 2 km, is controlled via a pair of remote controllers, though a single pilot suffices to operate the drone and its camera.¹⁰ With a smart device (such as a smartphone), a downloadable app (updatable, as is the drone firmware), and an internal Wi-Fi connection, first-person-view (FPV) is enabled – that is, the user can see what the camera sees.¹¹ With an On Screen Display (OSD) module installed, the user can also see live parameters such as speed and altitude on the smart device.

The Global Positioning System (GPS) that is built into the drone assists in keeping it relatively still when hovering (even when indoors) and also acts as a fail-safe if emergency homing or emergency landing is activated. It is possible to pre-program flight paths using the relevant software/hardware, and the drone also has built-in height and speed limits (updatable by firmware updates) if the GPS detects that the drone is in the vicinity of restricted areas such as airports. Piloting – including taking off and landing – the Inspire 1 is straightforward even if one does not limit the movements to basic manoeuvres. Before flight, a series of simple checks will ensure that calibrations and orientations are all set. The common users of Inspire 1? Mostly hobbyists exploring new ways to take videos and photos of any conceivable landscape, and people who are on a budget – the Inspire 1 is an integrated system that costs USD 3000 all in (probably USD 2000 by year-end). For comparison, this is the S1000, also built by DJI (© DJI):

⁷ <http://www.dji.com/product/inspire-1/spec>.

⁸ The file formats are DNG and JPEG, which means there is an option for greater detail recovery.

⁹ It can also shoot HD and FHD between 24 to 60 fps. The file formats are MPEG-4 and H.264.

¹⁰ The drone and its camera can be panned (left and right) and tilted (up and down).

¹¹ The frequency used is 2.4 GHz as opposed to 5.8 GHz. It is possible to extend the range of the transmission with separate transmitters, receivers, and monitors (the Light Bridge suite comes to mind).



This model is clearly aimed at professionals and there are some immediately obvious differences from the Inspire 1, the chief of which apart from size, weight, and price (the full basic system cost is easily USD 8,000) are the number of propellers (8 instead of 4) and the payload (the camera, which is customizable and not integrated). Things become more intimidating here when the dimensions and specifications are contrasted with the Inspire 1.¹² Made up of more metal parts, the S1000 with the key accessories added weighs only slightly heavier at 4 kg but more importantly, it has a maximum takeoff weight of 11 kg. It is usually paired with a sophisticated gimbal for high-end cameras such as the Canon 5Dm3 (which weighs about 1.4 kg with a wide-angle prime lens) or Panasonic GH4 (which weighs about 1 kg with a wide-angle prime lens). These interchangeable-lens cameras have much bigger sensors and are capable of exponentially better photo and video quality even under strained lighting conditions, and are therefore suitable for professional, broadcast-quality work.

In terms of other features, the S1000 is not that dissimilar from the Inspire 1. Even with a much higher-capacity 22,000 mAh battery, flight time is limited to less than 20 minutes because of the greater weight. The ascent and descent speed limits are about the same, as is the top speed range (around 15 m/s). The range of the wireless transmission for the purposes of controls and FPV is essentially the same (up to 2 km). With the extra propellers, however, there is some room for redundancy. This means that should a propeller fail, the drone will not crash as compared to a tri-copter or quad-copter which most certainly would if a propeller fails. And with the extra heft and more solid construction, an octo-copter like the S1000 is generally more resistant to weather changes such as wind conditions, though of course the imagination of a larger drone crashing is also going to induce more fear in people than the more benign-looking Inspire 1. But as will be explained below, neither the S1000 nor Inspire 1 is anything close to a crop-dusting, surveillance-capable, missile-launching drone.

C. A pre-emptive rebuttal as to why the three broad concerns are all largely illusory or misconceived

Now that one has a more concrete idea of the level of technology we are looking at, how does one preliminarily conclude that the three broad concerns of safety, privacy, and commercial interests are largely illusory, and that any attempt to legislate and regulate

¹² <http://www.dji.com/product/spreading-wings-s1000/spec>.

needs to be more circumspect – especially considering that we are looking at recreational, and not professional applications of such technology?¹³

With respect to safety, one needs to first bear in mind that as technology advances, so too will reliability, fail-safes, and ease of use (this of course has its downsides, a point which we will return to soon). This being relatively nascent technology, there are no readily available statistics, studies, or obvious indicators to show how reliable the Inspire 1 and S1000 truly are.¹⁴ There will of course always be the occasional, alarmist report of a crashed drone or an irresponsible use of the drone that caused some unnecessary panic but how representative are such reports? Perhaps identifying the principal causes of crashes will help for a start.¹⁵

A survey of the relevant peer-support pages and forums for recreational roto-copters – not quite the most complete repository for the data and evidence, but at least in those parts there will be less incentive to be imprecise or hyperbolic – will show that many crashes (and fly-aways) are attributable to avoidable and explainable causes, such as the failure to execute mandatory pre-flight procedures, flying in bad weather, flying without line of sight, flying in places with high wireless interference (this is just part of the larger problem of bad environmental awareness in general), flying on inappropriate occasions, bypassing manual controls, or pushing the speed/altitude/battery-life limits. If this is true, then any new regulation should be targeted at prohibiting and punishing bad practices, rather than be predicated on the assumption that the technology is inherently unstable or dangerous, that the control of the technology is difficult to master, or that innovation in this field is totally worth destroying. Indeed, most recreational photography tasks involve rudimentary ascent, panning, and descent movements – much of the initial framing of the shot can be done with the feet, on the ground, and FPV is a supplemental rather than indispensable tool. Videography is admittedly different, as the nature of the task requires considerable movement as part of the capture in both the technical and aesthetic sense. But just as any “ground” videographer worth his salt is not going to shoot without first visualising and planning the shot, the opposite should not be assumed of an “aerial” videographer, recreational or otherwise. And just as existing causes of action (such as those found in tort law) that punish bad drone practices do not extinguish just because the use of recreational drones is a recent phenomenon, new and more onerous laws should not be passed blindly without first considering if any attendant new threats are truly of a different nature.

¹³ In this regard the writings of Professor David Goldberg – especially in relation to journalism rights – are also instructive.

¹⁴ It is a safe assumption that they are representative technology, because even though DIY-rigs do exist (and are preferred by users with more experience), more and more are turning to pre-built drones and DJI, as mentioned, is the leading manufacturer today.

¹⁵ Since we are on the topic of safety, the earlier reference to a terrorist attack might as well be put to rest here – there are simply cheaper, more efficient, and more effective of conducting a terrorist attack than using a drone. Why? In the main, most mainstream drones are not designed to be amenable to carry out bomb attacks, be it in terms of payload, FPV-preclusion, speed limits, time limits, or absolute precision in flight controls. And as is the case with guns, people who wish to commit crimes with them are not going to be deterred by rules banning their use – they will get their weapons by hook or by crook. If they somehow decide to use a drone to carry a terrorist attack, it is not hard to build their own drone anyway even if they cannot purchase a ready-made one.

With respect to privacy, objections that are of the close-surveillance variety are probably the furthest removed from reality. First of all, even small, consumer-level drones are extremely audible hundreds of metres away – technology has not reached a point where rotors and propellers make minimal noise. In other words, recreational drones are neither suitable for spying nor a smart tool to be used by voyeurs, unless those preyed upon have hearing problems (and even then most drones are rather conspicuous). Secondly, as of now and the foreseeable future, consumer-level drones can only be equipped with cameras that are completely incapable of close-up spying. As a matter of image quality, the small sensor and optically basic lens combine to produce mushy images no different from smartphones. This is just the irrefutable reality of tiny sensors and tiny lenses. As a matter of focal length, not only is optical zooming not possible at present, the wide-angle lenses that are fitted on recreational drones are the antithesis of the telephoto lenses required for spying: a landscape photo, digitally zoomed and cropped to isolate a subject, is a useless photo to a spy, or an evil corporation bent on collecting data with an eye-in-the-sky.

Simply put, it does not make sense to spend thousands of dollars on something that does not do the job of spying as well as cheaper and more effective means. Ground cameras, telescopes, bugged devices, and the like are the way to go for that job. What about prosumer or professional drones then? They can be fitted with better cameras and lenses, but that also means they will be more conspicuous and much louder – an even worse way to spy. Pocket-sized drones¹⁶ that do not make much noise, you say? Again, technology has not reached a stage where sensor and lens limitations can be overcome by will, so the image deficiency problem is only worsened. Moreover, a drone that is so small that it can barely be seen will simply be blown away by the slightest of winds. The proliferation of drones has not changed the laws of physics.

As mentioned, however, one strand of the privacy concern is that of the expectation to complete tranquility. To this, one can only say: a drone is audible, but not unbearably, incessantly loud.¹⁷ For places to justify ban drones on the basis of tranquility, internal consistency should be upheld: for a start, all private land vehicles must be banned, because they not only pollute and light-pollute, they generate considerable noise as well – and they of course often result in road kill of harmless animals. The arbitrariness of the tranquility justification comes into clearest focus when one considers that the number of land vehicles will always vastly outnumber the drones. Before departing from the safety and privacy concerns, there is the matter of journalists using drones in restricted areas.¹⁸ This argument is an alarmist-driven non-starter and proponents of journalism should not introduce a false dichotomy between freedom of the press and national security interests either. If a place is restricted, then it is restricted and off limits. The public has no business being in or around restricted government buildings, whether using a drone or otherwise. The proliferation of drones has not overridden existing restrictions, and for this reason highly proximate intrusions over privately

¹⁶ See for instance <http://www.thepocketdrone.com/>.

¹⁷ If the objection is against large gatherings of drones, then any regulation should be directed against such assemblies, rather than against individuals or small groups of users who do not generate any more noise than groups of people congregating.

¹⁸ See for instance <http://www.straitstimes.com/news/world/europe/story/police-report-dozen-drone-sightings-over-paris-20150304>.

owned airspace are not acceptable either – provided there is indeed such ownership established.

With respect to the interference with commercial interests or the disruption of monopolised rights, this really depends on how possible it is in the first place to purchase perspective – or the rights of others without them even realising they have been forcefully acquired. If an event is held in a venue where access can be controlled – say a stadium – there can be no argument that a person without a ticket is not allowed entry, or that once a person is inside he has agreed to be bound by the rules set out for photography and videography. Thus, if he does not like those rules, he should not buy the ticket. But do the rights-holders of the event (including the organiser and the exclusive broadcasters) have rights over persons outside of the venue, particularly above the venue?¹⁹ Can a person living in a high-rise building beside a stadium not watch the action from his home? By parity of reasoning, a person should, in principle, be allowed to capture footage of the event using a drone, provided that he does not intrude into the physical space of the premises and more importantly, he does not pose a safety hazard to the people in such a crowded place. Therefore, the real issue is that of safety, and not that of event organisers suddenly possessing rights that did not exist.

III. An examination of some of the legislative frameworks and responses in this region and beyond

Turning then to the question of how laws and regulations have been used to appease the public concerning the use of recreational drones, the approaches adopted by the some of the countries in the region and beyond can be divided along the following lines: use existing but antiquated laws, at least as an interim solution; create new but generally overreaching laws; and a combination of wait-and-see and tweaking proposed legislation. A few jurisdictions reflecting these approaches would be considered here, ranging from the sensible to the not so sensible.²⁰

A. Example 1: Singapore, using old laws for new technology

In Singapore, the use of recreational drones has been steadily on the rise and the government has been mulling over new legislation for a couple of years already – public consultations are still ongoing, though it is unclear if the full range of stakeholders has been approached.²¹ The current relevant law that is being applied is found in the Air Navigation Order,²² which is subsidiary legislation. Under paragraph 64C(1), “a person shall not fly or operate any model aircraft ... (a) at any altitude within 5 km of any aerodrome; or (b) at an altitude higher than 200 feet above mean sea level in any place

¹⁹ See <http://www.theguardian.com/world/2014/oct/26/drones-permit-uk-british-airline-pilots-association-unmanned-aircraft-house-of-lords>.

²⁰ One suspects there will eventually be international standards established (by the International Civil Aviation Organisation (ICAO) for instance, which recently released its Manual on Remotely Piloted Aircraft Systems), but not only will this take some time (as is the nature of the formation of international laws), there is still the question of domestic implementation. For these reasons, this article will not propose to consider suitable international standards, but will instead consider samples of various domestic approaches.

²¹ <http://digital.asiaone.com/digital/news/rise-drones>.

²² 1992 Rev Ed.

beyond 5 km of any aerodrome.” According to paragraph 64I, “model aircraft” refers to “any aircraft that weighs not more than 7 kg without its fuel and that is capable of being flown without a pilot” while according to paragraph 2 “aerodrome” refers to any “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”. Clearly, paragraph 64 could not have contemplated recreational drones as they are known today, either in terms of the nature of the aircraft or the purpose of the aircraft. The Air Navigation Order also does not distinguish between recreational and commercial use of the drones, which is significant because generally, recreational users should not be taxed for enjoying a hobby if they are flying within limited airspace.

Turning to other aspects of the legislation, a person (who presumably is interested in using his drone for professional applications) may apply for a written permit granted by the Chief Executive of the Civil Aviation Authority of Singapore (CAAS) to be exempted from paragraph 64C(1), but the latter is at liberty to impose any conditions as he thinks fit. The application has to be done at least 7 working days before the date on which the activity in question is intended to be carried out. Apart from the twin conditions in paragraph 64C(1), paragraph 64C(5) states that a person “shall not fly or operate a model aircraft ... unless he is reasonably satisfied that the flight of the model aircraft ... will be conducted safely and will not pose a hazard to any person, aircraft or property.”

In other words, under the Air Navigation Order, there are at least three conditions to be adhered to for a hobbyist aerial photographer or videographer in Singapore – and as a Singaporean I feel obliged to comment a little more on this legislation first. As a preliminary impression, the prohibition of flights within 5 km of any aerodrome seems reasonable and proportionate. However, the definition of “aerodrome” is very broad, and would include not just airports, airbases, and airstrips but even helicopter landing pads as well. As Singapore only runs 40-odd km from east to west and 20-odd km from north to south and there are quite a number of places that would theoretically qualify as aerodromes under the Air Navigation Order, this essentially means that it is impermissible to fly any recreational drones in almost all of Singapore, and this restriction will seem on the face at least rather disproportionate.²³ Either the radius should be reduced, or more sensibly, the definition of “aerodrome” should be narrowed down to cover only airports and airbases.²⁴ Then there is the question of whether flying indoors, even within 5 km of airports and airbases, should be prohibited. The legislation should be amended to clarify this by answering in the negative. Any threat presented by a potential crash is clearly limited to the indoor environment in question.

The height limit of 200 feet above mean sea level is also restrictive, though not as disproportionately so as the preceding restriction. 200 feet is roughly equivalent to 60 metres, or a short building by any given measure – the purpose and utility of aerial photography and videography are immediately defeated with this height restriction that

²³ See <http://www.singaporelawblog.sg/blog/article/53>.

²⁴ Although the CAAS has since clarified the reach the no-fly zone (<http://www.caas.gov.sg/caas/en/ANS/area-limits.html>), it is better to achieve clarity in the law.

is much lower than the limits of many countries.²⁵ A more reasonable and technology-agnostic restriction that is in line with some other jurisdictions would be 500 feet, considering that when this restriction is coupled with the 5 km prohibition, there is no real threat to the flight trajectories of commercial or military aircraft. If the concern is the loss of line of sight, FPV and OSD technology are now relatively reliable and are improving quickly by the day, or alternatively, line of sight can be made a mandatory requirement in the regulations as is done in some countries – it is accepted that loss of FPV is difficult to mitigate at this point.²⁶ If the concern is the loss of control, path-pre-programming and homing technology are also relatively reliable and improving quickly by the day. Built-in speed caps can also be made mandatory since speed is seldom the key to any aerial photo or video project. For completeness, the distance limitation should not be confined to height: it is generally unwise to remotely fly a model aircraft from kilometres away, even if at a low height or in good weather conditions. Moreover, flight-times are unlikely to increase exponentially in the near future given the inherent limitations of battery power and capacities, so the default approach should be conservative.

The current requirement for reasonable satisfaction of safety is fair. But this also means that attempts to impose further restrictions will be unduly oppressive on a person's freedom to express, create art, or even gather news.²⁷ The argument from safety will always seem compelling for the reasons described in the Part II of this paper. However, paragraph 64C(5) of the Air Navigation Order is already very clear, not to mention a general duty of care already exists under tort law (negligence specifically). What should be done instead that hobbyists should be educated on flight safety, such as avoiding flights in bad weather, in sensitive areas, or where there are large crowds in the vicinity? Some system accreditation may help, but as mentioned earlier most aerial photography and videography projects are very straightforward and not at all complex. Bureaucracy should therefore be avoided and not adopted just to assuage illusory fears. This is why the rather opaque requirement (insofar as it is not found in the Air Navigation Order) imposed by CAAS on its website²⁸ for a permit to be acquired before aerial photography (videography is not included for some reason) can be performed – regardless of whether it is recreational or commercial in nature – is a step in the wrong direction. A permit does absolutely nothing for safety and there is no check-and-balance against a paranoid bureaucrat who can simply reject as many applications as he wants without reason so as to “play it safe”. As will be seen in the remainder of this survey, in requiring a permit for all uses of drones, Singapore is unsurprisingly in the minority in this regard.

²⁵ The United States for instance is proposing 500 feet (<http://rt.com/usa/232603-drones-regulations-ban-faa/>) and the United Kingdom's current limit is 400 feet (<http://www.caa.co.uk/default.aspx?catid=1995&pageid=16012>). Both of these jurisdictions will be explored in greater detail later.

²⁶ The United States is again one such example (<http://rt.com/usa/232603-drones-regulations-ban-faa/>), as is the United Kingdom (<http://www.caa.co.uk/default.aspx?catid=1995&pageid=16012>).

²⁷ See also <http://www.singaporelawblog.sg/blog/article/53>. In Singapore at least, with the constant promotion of citizen journalism (via STOMP for instance), there is somewhat of an expectation that citizens do play an important role in delivering news content (or content that is different from traditional means and scopes).

²⁸

http://www.caas.gov.sg/caas/en/Regulations/Airspace_Management/Air_Navigation_Hazard_x_Obstruction_Policies/Aerial_Photoshoot.html.

B. Example 2: United States, proposing new legislation

The United States will always be at the forefront of coming up with new legislation and any of that relating to recreational drones will no doubt be analysed closely by the rest of the world, and indeed the Department of Transportation's Federal Aviation Administration (FAA) has already in February 2015 proposed a new framework of regulations (Proposed Part 107 or PP107) for "small unmanned aircraft systems".²⁹ Notably, the FAA explained that in developing this new framework, it "tried to be flexible" as it wanted to "maintain today's outstanding level of aviation safety without placing an undue regulatory burden on an emerging industry."³⁰ It also said that one of the main aims is to "safely accommodate innovation", which shows quite clearly that it recognises the utility of drones, although it did not specify which types of drones and applications it had in mind.³¹ The new framework, which applies only to private individuals and not government operations, comprises three distinct parts: operational limitations, operator certification and responsibilities, and aircraft requirements.³²

With respect to the first part, the aircraft cannot exceed 25 kg and cannot be flown at greater than 100 mph and 500 feet above ground level.³³ The proposed regulations also explicitly state that visual line of sight must be maintained at all times; this means FPV cannot be used in lieu of visual line of sight under any circumstance.³⁴ Consistent with this insistence on clear and uninterrupted visuals is that the aircraft can only be flown when there is daylight (which is determined by the official sunrise to sunset times of the place in question) and when there is visibility of 3 miles from the control station.³⁵ There is a general obligation for the operator to perform the necessary preflight inspections, while during the flight he must operate the aircraft in a non-careless or non-reckless way.³⁶ Airworthiness certification is not required for the time being.

All of these operational limitations are fairly reasonable, though the upper weight limit reveals some broad-brush indiscrimination. 25 kg is well into the realm of super high-end professional equipment used for very particular commercial purposes such as big-budget film-making or comprehensive aerial surveys. Consumer- and prosumer-level drones that are used for less complex photography or videography, even when armed

²⁹ http://www.faa.gov/news/press_releases/news_story.cfm?newsId=18295. The public consultation/comment process would end later in 2015 before the next phase kicks in.

³⁰ http://www.faa.gov/news/press_releases/news_story.cfm?newsId=18295.

³¹ http://www.faa.gov/news/press_releases/news_story.cfm?newsId=18295. Unfortunately, in this same press release, the government's misguided prejudices were in full display as well: "earlier today, the White House issued a Presidential Memorandum concerning transparency, accountability, and privacy, civil rights, and civil liberties protections".

³² http://www.faa.gov/regulations_policies/rulemaking/media/021515_sUAS_Summary.pdf.

³³ This is a slight increase of the previous limit of 400 feet: <http://knowbeforeyoufly.org/for-recreational-users/>.

³⁴ This is similar to the previous requirement: <http://knowbeforeyoufly.org/for-recreational-users/>.

³⁵ Previously, there was a requirement not to fly in adverse weather conditions: <http://knowbeforeyoufly.org/for-recreational-users/>.

³⁶ Previously, there was a more specific requirement of avoiding interference with manned aircraft operations and avoiding flying over unprotected persons and vehicles and remaining at least 25 feet away from individuals and vulnerable property (including sensitive infrastructure): <http://knowbeforeyoufly.org/for-recreational-users/>.

with high-performance cameras and a strong suite of accessories, are unlikely to exceed 10 kg even in the foreseeable future. Similarly, a speed limit of 100 mph is also not really necessary.³⁷ This is because from the perspective of recreational videography and photography at least, high speeds are seldom needed to achieve the looks needed – high speeds in terms of high frame rates for videography, perhaps. But to be clear, the problem of indiscrimination is not with regard to the operational limitations, but the next part.

With respect to the part on operational certification and responsibilities, PP107 requires the operator, who must be at least 17 years of age, to fulfill the following: pass an initial aeronautical knowledge test at an FAA-approved knowledge testing centre; pass a recurrent aeronautical knowledge test every 24 months; be vetted by the Transportation Security Administration; obtain an operator certificate; make available to the FAA, upon request, the aircraft for inspection or testing, and any associated documents required to be kept; and report any accident to the FAA within 10 days of any operation that results in injury or property damage. While these requirements are not as onerous as the once-rumoured – and nonsensical – proposal of operators needing to possess pilot licences, they are still unnecessary and excessive for the purposes of recreational drone photography and videography.

To be precise, the non-stop testing and certification requirements are particularly problematic. They presuppose that the operation of drones is difficult and that the manoeuvres to be executed are complex. This presupposition is challengeable depending on the application. As far as recreational drone photography and videography are concerned, millions of users have been operating these drones without difficulty or incident, and the operation of these devices is only likely to become easier and not more difficult as technology improves. It makes sense to generally educate users on the limits of the equipment and the basics of aerodynamics, but it is quite another thing to require testing, recurring testing, vetting, and certification. This is, fully consistent with the American administration of late, just pure governmental overreach without understanding the nuances of the technology and most importantly it costs a lot of time and money for everyone, with the likely eventual effect of freezing expression of recreational users.³⁸ In fairness, the PP107 does not propose to create an indiscriminate pay-for-permit system so as to generate an income stream for the government. But this does not make the extension of what appears to be certification rules targeted at professionals to recreational users. The other negative effect of a permit system – bureaucratic delay – is even more alive in a certification system.

C. Example 3: United Kingdom, tinkering with existing legislation

³⁷ The only conceivable application for such high speeds might be operations relating to search and rescue, but as mentioned, government operations are exempt from the PP107. Perhaps PP107 is trying to accommodate users who engage in racing, but if that is the case, the fact that it does not contemplate separate rules for recreational photography and videography can only be described as puzzling.

³⁸ See also http://www.slate.com/articles/technology/future_tense/2015/02/reuters_ipsos_poll_shows_42_percent_of_americans_support_private_drone_ban.html; <http://www.myfoxtampabay.com/story/28417965/drone-hobbyist-gets-cease-and-desist-letter-from-the-faa>. However see <http://www.hardwarezone.com.sg/tech-news-amazon-gets-green-light-faa-begin-drone-testing>.

Moving across the Atlantic, the United Kingdom is also seeing an exponential increase in the use of drones for recreational purposes.³⁹ The Civil Aviation Authority (CAA) recently espoused the view that the traditional use of unmanned aircraft by model aircraft enthusiasts have been largely problem-free, but that the use of drones for professional applications such as “surveillance and data-gathering ... may pose a greater risk to the general public.”⁴⁰ It added that the regulations are aimed at “being as light touch and proportionate as possible, so there is a great deal that can be done (especially for private or recreational flights) without the need to approach the CAA at all.”⁴¹ But instead of being content to leave the recreational usage of drones to be regulated by dated laws, it refreshed its legislation just earlier this year. However, the governing provisions actually remain rather limited in number and scope.

Articles 166 and 167 of the Air Navigation: The Order and Regulations 2009 (ANTOR),⁴² entitled “Small unmanned aircraft”⁴³ and “Small unmanned surveillance aircraft” respectively, are the two main provisions that set out the obligations. Under article 166, there must be: reasonable satisfaction of the safety of the flight before flight; the maintenance of direct and unaided visual contact with the aircraft so that its flight path can be monitored to avoid collisions; avoidance of aerodrome traffic zones; restriction of the flying height to not more than 400 feet above the surface; and avoidance of commercial work unless permission is granted by the CAA.⁴⁴ Under article 167, the aircraft cannot be flown: over or within 150 m of any congested area;⁴⁵ over or within 150 m of an organised open-air assembly of more than 1000 persons; within 50 m of any vessel, vehicle, or structure not under the control of the pilot; and within 50 m of any person (other than the pilot). For take-off or landing, the aircraft must not be flown within 30 m of any person (other than the pilot(s)).

Apart from articles 166 and 167, not much else is provided for even though the ANTOR was refreshed only a few months ago.⁴⁶ On the one hand, this rather conservative

³⁹ <http://www.telegraph.co.uk/technology/news/11280802/Drones-the-rules-about-flying-them-in-the-UK.html>.

⁴⁰ <http://www.caa.co.uk/default.aspx?catid=1995>.

⁴¹ <http://www.caa.co.uk/default.aspx?catid=1995&pageid=16006>.

⁴² 2015 Rev Ed. See also <http://www.caa.co.uk/default.aspx?catid=1995&pageid=16012> and <http://www.caa.co.uk/docs/1995/CAP%201202UAVsafetyrules.pdf>.

⁴³ Article 255 defines such aircraft as “any unmanned aircraft, other than a balloon or a kite, having a mass of not more than 20 kg without its fuel but including any articles or equipment installed in or attached to the aircraft at the commencement of its flight”. Fuel would include batteries: <http://www.caa.co.uk/default.aspx?catid=1995&pageid=16011>.

⁴⁴ Permission is also required if the flight takes place within congested areas or close to people or properties not under the control of the pilot: <http://www.caa.co.uk/default.aspx?catid=1995&pageid=16006>.

⁴⁵ Article 255 defines a congested area as any area which is substantially used for residential, commercial, industrial, or recreational purposes.

⁴⁶ This of course does not mean that other legal obligations do not exist outside the ANTOR, such as privacy and data obligations created by the Data Protection Act. However, for reasons given in this article, such issues cannot seriously be said to arise in the context of the technology deployed in recreational photography and videography. The fact that a picture or video is taken by an aircraft does not transform its nature from that of a picture or video taken by a person on the ground (which is to say, taken all the time with no serious argument to be made for only sweeping landscapes with no identifiable individuals in the shot that can be taken). Moreover, given the 50–150 m distance that must be kept between the aircraft and persons, it is all the more impossible for privacy concerns to arise.

approach is laudable because the government in the United Kingdom recognises that over-regulation will be detrimental to recreational users.⁴⁷ At the same time, however, under-regulation may lead to some uncertainties in the law and recreational users, generally being less savvy and having less resources, may not be able to fully discern their rights and obligations, especially if it is assumed that laws that have recently been refreshed will stay the same for a while. Having said that, the specified 30–50 m distance to be kept from people and buildings may be a little restrictive; so too is the 150 m distance to be kept from congested areas (it is accepted that the prohibition against flying over congested areas is fair). A literal adherence to this regulation would mean that the flying is going to be largely confined to big parks and suburban areas. For the purposes of aerial photography and videography, this will be difficult to accept as there is more to shoot than just those limited places. Perhaps a combined system of insurance and expedient permits may be one way to mitigate the harshness, but again the likelihood of the ANTOR being amended (in the sense of changing the parameters of articles 166 and 167) so soon after it was updated is very low.

D. Example 4: a total freeze on freedoms and a point of no return

If all the examples of regulation thus far still seem quite acceptable (or at least not that oppressive), countries that have completely gone the other direction do exist. Perhaps the most prominent example is Spain, where in 2014 AESA, the state agency for aerial security, issued by executive fiat a blanket ban on civilian drone use everywhere in the country.⁴⁸ This startling overreach was already foreshadowed by developments in other countries such as South Africa, which government in 2014 also claimed that all recreational and commercial use of drones were banned by default, and offenders would be jailed for 10 years and fined.⁴⁹ The South African Civil Aviation Authority (SACAA), while admitting that regulating drones would be a complex matter and that it was only beginning to understand how they worked, even claimed that at the very least, operators must possess pilot licences for manned aircraft; after much public outcry, good sense prevailed, SACAA relented after consulting with stakeholders, and it has now proposed a new set of draft regulations instead, which contain much more reasonable provisions.⁵⁰

But going back to the case of Spain, what could have prompted their decision to completely ban the use of drones, without even providing for exceptions such as permits and accreditation requirements? No one knows for certain, so one can only speculate. What is known is that when AESA announced the ban, it noted that the use of drones was “recent” and that it wanted to avoid “possible incidents”.⁵¹ It elaborated: “The use

⁴⁷ Yet, governmental overreach has begun to manifest itself, with the Secretary of State recently announcing unilaterally that drones cannot be flown in parks: <http://www.engadget.com/2015/03/09/drone-royal-parks-ban/>.

⁴⁸ http://www.businessinsider.sg/drones-banned-in-spain-2014-4/#.VP_mceEYnoY; <http://qz.com/200011/spains-sudden-ban-on-drones-is-a-punch-in-the-gut-for-its-film-industry/>; <https://www.thespainreport.com/4640/narrow-minded-ban-commercial-drones/>. This disrupted a lot of film-makers’ shoots who had planned various aerial shots around the country.

⁴⁹ <http://traveller24.news24.com/News/Flights/SA-takes-lead-in-drafting-drone-regulations-20150306>.

⁵⁰ <http://dronelaw.com/2015/01/22/south-africa-moves-forward-drone-regulations/>.

⁵¹ <https://www.thespainreport.com/4617/spain-bans-civilian-drone-use-across-whole-country-commercial-purpose/> (based on an English translation).

of aircraft piloted by remote control with commercial or professional ends is not permitted, and never has been, in order to carry out activities considered aerial work.”⁵² Then came the most astonishing remark, that aerial filming (among other related aerial operations) “require authorisation from AESA ... [but] AESA cannot issue said authorisations because there is no legal basis to do so.”⁵³ In other words, not only was the use of drones for commercial purposes banned, the use of drones for recreational purposes would also have been banned since by parity of reasoning there was “no legal basis” to use drones in Spain at all.

Other countries have since swiftly and blindly followed the Spanish model of blanket banning. In India, the state police departments of Mumbai and Kolkata have banned the use of private drones, claiming that they pose security threats, without elaborating on the whys, hows, and the exceptions.⁵⁴ In the United Arab Emirates, the sale of recreational drones has been banned in Abu Dhabi, with government officials asserting that cameras on drones would be used for “illegal activities”.⁵⁵ In Morocco, security concerns – potential terrorist attacks, specifically – were cited for the ban.⁵⁶ In Thailand, the use of drones that carry cameras has been banned, and the flying of drones is not permitted unless authorisation has been sought; failure to comply will result in a fine and imprisonment.⁵⁷ There are many other examples, and the list of examples will only increase⁵⁸ as governments continue to react with remarkably swift paranoia to a problem they do not even try to understand and to a problem that does not even truly exist – if only they were able to solve real problems afflicting their countries with such decisiveness and ease. Is there hope yet for recreational drone users, or have matters reached a point of no return in this category of countries?

E. Example 5: Australia, on the cusp of going overboard

Just like the United States, Australia has one eye on the future, except that Australia was also the first country in the world to regulate remotely piloted aircraft when it introduced regulations in 2002.⁵⁹ While the recreational use of drones for photography and videography has not quite taken off as strongly Down Under, the Civil Aviation Safety Authority (CASA) has been monitoring the situation and is likely to introduce radically different (as in radically oppressive) legislation soon.⁶⁰ For now, however, as a starting point, it usefully distinguishes between recreational and professional use – this is usually a good sign, though one that may not last for long. The current rules are quite

⁵² <https://www.thespainreport.com/4617/spain-bans-civilian-drone-use-across-whole-country-commercial-purpose/> (based on an English translation).

⁵³ <https://www.thespainreport.com/4617/spain-bans-civilian-drone-use-across-whole-country-commercial-purpose/> (based on an English translation).

⁵⁴ <http://www.thehindu.com/news/cities/kolkata/private-drones-not-allowed-says-kolkata-police/article6830322.ece>.

⁵⁵ <http://www.thenational.ae/uae/sale-of-recreational-drones-banned-in-abu-dhabi>.

⁵⁶ <http://www.msn.com/en-us/news/other/morocco-bans-import-of-drones-citing-security-concerns/ar-BBhXZQx>.

⁵⁷ <http://www.bbc.com/news/technology-31001121>.

⁵⁸ See for instance the situation in Brunei: <http://thediomat.com/2015/03/brunei-mulls-new-drone-regulations/>.

⁵⁹ http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_100376.

⁶⁰ <http://www.smh.com.au/digital-life/digital-life-news/drone-rules-to-be-toughened-in-new-year-following-several-australian-incidents-20141228-12eogi.html>.

similar to the United Kingdom's ANTOR so they can be briefly stated. The pertinent ones for recreational users are as follows:⁶¹ the drone can only be flown at least 30 m away from people; the height limit is set at 400 feet; it may not be flown over large gatherings of people; line of sight must be maintained at all times; it may only be flown in daytime; and it may not be flown within 5 km of an airport.

In theory, it is possible for violators to be prosecuted and fined a hefty sum, but there has been no known test case, as is the situation in many jurisdictions (in fact the sanctions that may follow are often not even spelt out). As for commercial users, the long and short of it is that there is a certification process and a permit required before any flying can be done. Of course, there is a bit of an irony in all the jurisdictions that differentiate between commercial and recreational use in that one would think that recreational, rather than professional users pose a bigger threat to safety and should therefore be regulated more, but this is explainable insofar as professional equipment is more likely to be bulkier, capable of more powerful captures, and are of more potent specifications generally.

F. Example 6: Hong Kong, maintaining a true light touch

We round up our survey with another Asian player, Hong Kong, which has been described by a commentator as applying a “light touch” approach.⁶² This is not surprising and indeed not a mis-description in any way, since the various regulations established by the Civil Aviation Department (CAD) apply mainly to non-recreational users.⁶³ This is so even though Hong Kong, like Singapore, is an ultra densely populated place and has seen a great increase in the use of recreational drones as well. Indeed, the use of “unmanned aircraft systems” for recreational operations are classified as “model aircraft flying”, and no permit is required from the CAD as long as the aircraft is also not more than 7 kg.⁶⁴ With the exception of height limit (300 feet above ground level), the regulations⁶⁵ for model aircraft flying are expressed in relatively broad terms, such as: keeping a watch for any aircraft flying in the vicinity; keeping a safe distance between the aircraft and people on property on ground; no flying over populated and congested areas; no flying over or close to objects that present a risk if damaged by the aircraft; no flying in the vicinity of airports and main aircraft approach and take-off paths; no flying without line of sight; and conduct of flying during daylight hours only.⁶⁶

For comparison, the regulations that apply for non-recreational operations (in addition to the height and weight limits that apply to recreational users) are quite substantive and

⁶¹ <http://www.gizmodo.com.au/2014/10/what-are-the-rules-about-operating-a-drone-in-australia/>.

⁶² <http://www.sidley.com/news/01-15-2015-privacy-data-security-and-information-law-update>.

⁶³ http://www.cad.gov.hk/english/Unmanned_Aircraft_Systems.html.

⁶⁴ http://www.cad.gov.hk/english/Unmanned_Aircraft_Systems.html.

⁶⁵ The legal status of these regulations is unclear, as they do not appear to be derived from any publicly disseminated subsidiary legislation.

⁶⁶ http://www.cad.gov.hk/english/model_aircraft.html. Another country which is known for its enlightened approach is France, but their regulations are more specific and are also more similar to the regulations in the United Kingdom and Australia (as they currently stand): <http://www.france24.com/en/20150129-france-civilian-drone-legislation-lessons-usa-obama/>.

substantial, such as:⁶⁷ evidence of pilot competency;⁶⁸ no flying within 5 km of any aerodrome; no flying over or within 50 m of any person, vehicle, or structure not under the control of the pilot (30 m if taking off or landing); no loss of line of sight; pre-flight checks must be conducted; records of each flight shall be maintained and can be inspected upon request; ground visibility of not less than 5 km; surface wind of no more than 20 knots; and weather monitoring. Two separate applications to fly the aircraft must also be submitted to the CAD well before the intended date of operation, and there is also an undertaking to comply with other relevant laws, such as personal data privacy laws. Thankfully, however, all of these regulations only apply to commercial users. With revenue streams from clients, such regulations can be more easily adhered to and market forces take care of things. By quite a mile, Hong Kong is truly a paradise destination for recreational drone users who only just want to take better videos and pictures to be shared. It is the one jurisdiction that has preserved the rights of recreational users to express themselves, within reasonable limits.⁶⁹

IV. Consolidating the comparisons: the better way forward, and concluding thoughts

A good spread of countries has been considered in this article. The table below gives a quick visual comparison of the positions adopted/to be adopted:

Jurisdiction	Weight limit	Speed limit	Height limit	Distance limit	FPV only	General caution	Training required	Permit required
Singapore's Air Navigation Order (1992)	7 kg	NA	200 feet above mean sea level	> 5 km from aerodrome	NA	Ensure not a hazard	NA	If exceed height or distance limits
United States' PP107 (proposed 2015)	25 kg	100 mph	500 feet above ground level	At least 3 miles visibility	Not allowed	Ensure not a hazard	Knowledge test Recurring test Vetting Certification Inspection Reporting	NA
United Kingdom's ANTOR (revised 2015)	20 kg	NA	400 feet vertically and 500 feet horizontally	Outside aerodrome traffic zone > 150 m from congested areas > 30–50 m of any vehicle, structure, or	Not allowed	Ensure not a hazard	NA	If for paid commercial activity

⁶⁷ http://www.cad.gov.hk/english/Unmanned_Aircraft_Systems.html.

⁶⁸ However, even the CAD acknowledges that “currently there are no pilot licences for the operation of UAS. CAD accepts Basic National UAS Certificate – Small Unmanned Aircraft ... or equivalent for evidence of UAS pilot competency.”

⁶⁹ Having said that, the Office of the Privacy Commissioner for Personal Data, Hong Kong, did release in March 2015 a rather bizarre “Guidance Note” on the privacy issues that come with the use of recreational drones.

				person				
Australia's CASA regulations	NA	NA	400 feet	> 5 km from aerodrome > 30 m from people	Not allowed	Ensure not a hazard	NA	If for paid commercial activity
Hong Kong's CAD regulations	7 kg	NA	300 feet above ground level	NA	Not allowed	Ensure not a hazard	NA	If for paid commercial activity
India (some states), Morocco, Thailand, United Arab Emirates	Outright ban	Outright ban	Outright ban	Outright ban	Outright ban	Outright ban	Outright ban	Outright ban

Notably, different states have come to vastly different regulatory measures. This in and of itself is not surprising, except that most of the state responses have not evinced any attempt to either properly differentiate between the different types of drones and applications, or to even appreciate how the technology and its applications work in terms of inherent limitations. In other words, most of them define drones so broadly such that many things are essentially presumptively disallowed, rather than presumptively allowed, and all of this is without first mentioning that general duties under other areas of law do not suddenly stop applying to drone users. The only explanation for such lightning-speed over-regulation is a fear of the unknown, but the unknown is not the same as the unknowable. For the purposes of recreational drone photography and videography, based on the matters discussed in this article, the following recommendations should be adopted – bearing in mind that for many of the recommendations, it is possible (and indeed, more feasible) to ensure the regulation in question is complied with by making clear the limits to the manufacturer so that the final product, which is within the control of the manufacturer, already forecloses the possibility of those limits being breached (short of illegal hacking and modding):

- **Weight limit:** a net weight limit of 7–10 kg is more than enough for the foreseeable future when considering current drone and camera dimensions. People who are paranoid of objects falling from the sky should be aware that first, greater weight can actually reduce the chances of a mishap (because the drone would be less vulnerable to wind changes, and there will be greater room for propeller redundancy) and secondly, the weight limitation needs to be considered in light of the other regulations as well (such as people distance).
- **Height and distance limits:** a vertical limit of 400–500 feet above ground level should be enough for respectable vistas to be unlocked, and at the same time more than consistent with what existing technologies (such as FPV, wireless transmissions, and emergency homing as well as the physical build of the drones) permit to enhance the chances of a safe experience. The same should apply for distance limits, so the question that remains is whether FPV can be used in lieu of line of sight. This may depend on whether there should be a co-pilot requirement (that is, one who navigates and one who controls the camera). But strictly speaking, there is no real compelling reason for a recreational drone photographer or videographer to insist on being permitted to fly without line of sight.

- **Speed limit:** it is only in the most exceptional of circumstances that drones must fly at high speeds to achieve certain looks in photography and videography. At best a distinction can be drawn between flying in urban areas and open spaces, but there is simply no real need for a drone to be zipping around at high speeds in the context we are concerned with. Even 20 km/h is more than enough, and anything more than 30 km/h needs to be treated as the exception rather than the default. The same goes for ascent and descent limits, though these have generally not been prescribed yet.
- **Training and certification requirements:** these only make sense if the user wishes to engage in professional commercial work, where complex manoeuvres and maybe even navigation through non-ideal weather conditions are expected. Ready-to-fly drones are remarkably easy to handle even without didactic instruction, provided that the pre-flight procedures are executed. It therefore follows that any attempt to create a permit system would be most unnecessary. Of course, users should also be educated on the non-negotiables of flying, such as staying out of the way of airports, not getting in the way of emergency relief efforts, and avoiding densely populated places (out of safety and not because of any concession to non-existent privacy considerations). Citizenship journalism is nice in name, but things can easily go awry if there is no understanding of the non-negotiables.

In this article I have tried to sketch out the regulatory picture of what lies ahead for recreational drone users, particularly those engaged in aerial photography and videography. At the end of the day, recreational users simply do not have as much of a voice or impetus as corporate lobbyists; they are not seen as having any rights whatsoever; and they will always be forced to accept what poorly thought-out regulations and laws unilaterally imposed upon them. This will not just kill innovation, this will kill art, this will kill any desire to open new vistas for natives and travellers.



It is only apt to conclude with an example of the new vistas drone photography opens – and how oppressive regulations would close: my university, SMU, up until this point never captured before with the Singapore skyline that it so often identifies as being at the doorstep, captured from an unused neighbouring field and processed as an eight-panel panorama.