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ABSTRACT

Technology affects us in positive ways yet can also be disruptive; such is the case with Remotely Piloted Aircraft (RPA or more commonly known as drones). While drones are proving to be useful for military, commercial, civilian, and even humanitarian activities, their unregulated use carries serious consequences that need to be addressed. This paper examines drone operations in India and analyses the major policy gaps in the country's evolving policy framework. It argues that ad-hoc measures taken by state and central agencies have been ineffective, whether in addressing issues of quality control, or response mechanisms in the event of an incident, questions of privacy and trespass, air traffic, terrorist threat management, and legal liability. The paper makes a case for India to play a more proactive role in shaping global norms around the use of drones, as the evolution of these technologies could create an impact on the country's security in multiple ways.

INTRODUCTION

Technological advancements are changing human lives in numerous ways – be it the way wars are fought or businesses are conducted. Drones, also known as Unmanned Aircraft System (UAS), Unmanned Aerial Vehicles (UAVs) or Remotely Piloted Aircraft System (RPAS), reflect this change most aptly.[1] The military is no stranger to drones as forces have been using them for a variety of applications, such as surveillance and reconnaissance, in unknown or hostile territories, to track enemy movements, for border patrols, search and rescue missions, and emergency services. Armed versions of drones have been used to protect the lives of men and women in uniform as well as to target and kill enemy forces including terrorists. In the Indian neighbourhood, unmanned combat aerial vehicles (UCAVs) have been put to significant use in fighting al-Qaeda and Taliban in Pakistan and Afghanistan. In fact, in the late 1990s, as the hunt for Osama bin Laden intensified, Afghanistan became the laboratory for the US' development of armed drones.[2] However, it was only after the 9/11 terrorist attacks in the US did Washington sanction the use of armed drones. Since then, drones have been increasingly used for targeted killings and air support for ground troops across both Afghanistan and Pakistan. As former Director of the Central Intelligence Agency (CIA) Michael Hayden once wrote, "Targeted killing using drones has become part of the American way of war."[3]

UAVs have penetrated the commercial sphere as well, with businesses deploying drones in increasingly diverse roles. One of the world's largest online suppliers, Amazon, said in 2013 that it wants to use drones to deliver packages and has been testing the platform accordingly.[4] The company obtained permission to test drones in the US in April 2015, and in the UK in July 2016. Thereafter, Amazon did its first delivery legally in December 2016 in the UK in the university town

of Cambridge.[5] Though still experimental, such commercial uses are expected to soon become a reality. Already, drones are being used for developmental purposes, including aerial mapping, and for monitoring critical infrastructure such as ports and power plants.[6] The geospatial market using drones for surveying, mining, construction, to name a few, could possibly see a phenomenal increase in the coming decades. A recent report from Goldman Sachs put the global spending on drones over the next five years at approximately US$100 bn; a significant share in the commercial/civil sector is set to be focused on the construction industry.[7]

Explaining the emerging scenario, Mathew Wade, Marketing Director, senseFly, has said, "We have seen very big growth in the field of agriculture and that is going to be one of the strongest sectors in the future. I think the upcoming sectors can also be 'infrastructure' and 'inspection'. Think about bridges, dams and railways across the world and the figures are astronomical. All these need maintaining and checking regularly and that is a big opportunity for drones to grow big."[8] Information gathered using drones is a huge market. Intel UAV official, Anil Nanduri, states that the use of drones whether for "inspecting a bridge, a tower, inspecting any area after a natural disaster, the damage they do to buildings and surroundings... are all very intense work and are often even unsafe for human visits. Drones can be much quicker, faster and capture a lot of data — one drone flight can get you gigabytes of data, which needs to be processed."[9] He cites the example of the US and says there are around 600,000 bridges that need to be inspected; as infrastructure gets older, the need for monitoring intensifies, adding to the huge economic opportunities.

Given the potentially large-scale use of drones in the civilian and security domains, there appears to be a growing global drone industry as well. According to a study from Stratistics MRC, a US-based consultancy

firm, the global drone market was worth US$5.93 bn in 2015 and is estimated to grow to US$22.15 bn by 2022, representing a growth rate of 20 percent.[10]

As the global market for drones has grown, so too, have the debates on the legal, regulatory, and even moral issues around their use. So far, there are no clear global mechanisms yet present to regulate drone activities. There are also issues around accidents, air collision, safety and security of the use of drones. Each of these issues requires a comprehensive framework for effective regulation in the civilian airspace for domestic security, privacy and legal concerns to be addressed effectively.

This paper describes the regulatory mechanisms that are needed to ensure safe and secure drone operations in India, with emphasis on civil/commercial operations. The paper first examines the evolving policy framework, including the draft Director General of Civil Aviation (DGCA) Guidelines, and analyses the major policy gaps therein. Given the potentially large-scale use of drones in the non-security, commercial sectors including in agriculture and infrastructure, this paper argues, it is imperative that India fills these policy gaps. Stop-gap measures taken by different state and central agencies have not been effective—whether in addressing issues of quality control, or response mechanism in the event of an incident, questions of privacy and trespass, air traffic, terrorist threat management, and legal liability. The penultimate section looks at the global governance of drones to draw lessons for India as the country firms up its own regulatory and legal framework. The concluding section makes a case for India to play a more proactive role in shaping the global norms and regulations, not only as the evolution of drone technologies can have an impact on India's security in multiple ways, but also because it is better for India to be part of any new global effort as a norm shaper while at the same time protecting the country's interests.

USE OF DRONES IN INDIA: EVOLUTION OF POLICY

Much like in other countries, drones have multiple applications in India in the civilian domain such as in the commercial sector for mapping and information gathering, in addition to the military domain where its uses include surveillance and intelligence collection. However, the use of drones has been fraught with problems and uncertainties in the absence of well-laid out standards, regulations and operating procedures. One of the first Indian notifications on the subject came in the form of a Public Notice issued by the Office of the Director General of Civil Aviation (DGCA), India's civil aviation regulator, on 7 October 2014.[11] The document was useful for informing potential operators that "The civil operation of UAS will require approval from the Air Navigation Service provider [Airport Authority of India], defence, Ministry of Home Affairs, and other concerned security agencies, besides the DGCA. DGCA is in the process of formulating the regulations (and globally harmonize those) for certification & operation for use of UAS in the Indian Civil Airspace."[12]

Two years later, the DGCA released a set of draft guidelines on 21 April 2016 on the use of UAVs for civilian or recreational purposes. The DGCA invited comments on this circular from various stakeholders for a period of 21 days as decided by the Ministry of Civil Aviation. After a year and a half of inaction on the previous guidelines, in October 2017, the DGCA released a new set of guidelines. The civil aviation regulator has invited comment on the new guidelines with the aim of finalising them by 31 December 2017.[13] The guidelines appear, though, to be a mere product of dire necessity; they do not exhibit enough foresight. There have been several incidents in the past few years that show the dangers of unregulated use of drones for all stakeholders including the general public. Despite the near-blanket ban on drones, there has been a worryingly high number of sightings of UAVs in different areas across the country, which further highlights the need for effective regulations

to be enforced at the earliest. It cannot be emphasised enough that there is a need for a more nuanced regulatory framework with appropriate recommendations including tackling issues such as liability in case of mid-air collisions. India must lay out a policy framework that would address the regulatory, legal, operational, licensing and liability issues around the use of drones.

Draft DGCA Guidelines

On 30 October 2017, the DGCA announced a set of draft regulations for the use of UAVs in the civilian airspace. The circular came a year and a half after the last set of draft regulations on the same subject, which never came into effect. These regulations have incorporated the articles from the April 2016 circular along with a few additions. Even as it is hoped that these regulations will come into effect and remove the blanket ban, the track record does not look promising.

In the past year and a half, since they invited comment on the last draft Guidelines, little seems to have changed in the outlook of the DGCA towards the use of drones by civilians. The new draft does little to cover a range of vital topics left out in the 2016 Guidelines, and still fails to cover issues such as legal liability and import controls. These guidelines appear to have come as a stop-gap measure due to widespread criticism of the ban on UAVs for civilians and lobbying efforts by e-commerce brands.[14] Areas such as privacy and trespass, which require a larger legal debate, have been left entirely unaddressed by the DGCA in its guidelines. The guidelines appear shortsighted and do not attempt to predict or account for the rapid developments brought to the drones domain by Artificial Intelligence, miniaturisation and robotics.

It is evident that the objective of the guidelines is to prevent any disturbance to the operation of commercial aircraft due to UAVs. A lot of the rules, therefore, are intended at ensuring that commercial flights

operate without any interference from UAVs. However, the regulations do not address the threat, for instance, posed by two UAVs to each other nor the loss of life and property that might result from any accident between two drones.

Further, the guidelines do not account for a mechanism ensuring the safe operation of drones at low altitudes; nor do they have provisions for ensuring that there is no interference by two drones in each other's operations. As the number of drones populating Indian skies rapidly increases, this gap will become alarmingly glaring in the future and will have to be addressed soon.

According to the guidelines, drone operators will need to obtain a Unique Identification Number (UIN) for their UAV and security clearance from the Ministry of Home Affairs (MHA) before they can get their drone in the air. This UIN must be obtained by the operator following the submission of documents that provide the purpose of operation, drone specifications including manufacturer name, type, year of manufacture, weight and size, type of propulsion system, flying capabilities in terms of maximum endurance, range and height, and equipment capabilities. The operator will also have to provide a copy of the flight manual and the maintenance guidelines as issued by the manufacturer, as well as verification proofs. While this makes it simpler for authorities to trace the ownership of a drone that they may recover in case of an accident, the UIN must be only physically present on the drone with no form of electronic or digital identification currently required. The UIN will be assigned subject to security clearance; however, it is not specified what the basis of this clearance will be, as the circular simply mentions that it will be dealt with on a "case-to-case basis".

Operators flying UAVs over 200 feet above ground level also need to obtain an Unmanned Aircraft Operator Permit (UAOP) from the DGCA. This permit does put the operator under stringent scrutiny, but it is one

of the segments in the guidelines that is quite comprehensive and can be effective if implemented effectively. It ensures that operators are fully aware of all the restrictions on their use, thus protecting users from possibly violating a regulation of which they are unaware. However, regarding operators flying drones below 200 ft in controlled airspace, permission needs to be sought only from local administration.

The new regulations have been regressive in the requirement for Visual Line of Sight (VLOS) operations. In the 2016 guidelines, only Mini and Micro drones needed to be flown with VLOS.[15] The 2017 regulations stipulate that all UAVs, irrespective of weight category are to be flown maintaining VLOS. While most other countries impose such a limit on lighter drones, the blanket imposition of VLOS is going to stifle several uses of drones. It is clear that regulators are uncomfortable with operators relying on visual aids for the operation of these drones. These aids, while already quite developed, are only going to become more advanced and reliable in the near future. It seems unfair to clamp down on their use entirely.

All UAVs have to observe the rules on restricted, controlled airspaces and any danger areas as defined by the Aeronautical Information Publication as notified by the DGCA or the Ministry of Civil Aviation. The new guidelines however, have drastically reduced the no-fly zone area around Rashtrapati Bhavan, New Delhi, from 30 km in the 2016 guidelines to five km in the 2017 issuance. The radius of the no-fly zones around strategic locations as prescribed by the MHA as well as military installations has been reduced to 500 metres. These changes are certainly a positive step by the DGCA in the 2017 guidelines.

POLICY GAPS

While the DGCA has taken the first step of framing draft guidelines for the use of UAVs, there remain several gaps that must be addressed,

keeping in mind the need for balance between security concerns and legitimate uses of drones in a variety of civilian sectors.

Quality Control

The most striking absence in the regulations is that of import standardisation. As a sizable percentage of India's drones continue to be imported, there is a need to ensure their quality control and standardisation. No legislation addressing this aspect has been passed by the DGCA. The Department of Customs recently issued a notification placing drones on the list of dutiable items, making it mandatory to declare these at the time of import. However, when drones continue to be banned for civilian use by non-governmental entities, it still is not clear why Customs allows them to be imported. This again underscores the lack of coherence in policy on the subject between various state authorities and the DGCA.

Adding to the failure to address import quality standardisation of drones is the lack of policy on quality control of indigenously-manufactured and -built drones. There is no focused regulation regarding domestically-produced drones and the industry is left to its own standards, if at all it has any. Alarming is the fact that there are no guidelines in ascertaining the very airworthiness of a UAV.

The lack of policy on quality control and standardisation for both indigenously manufactured and imported drones presents several challenges. The legal liability for a drone comes under question as it is difficult to ascertain whether the device malfunctioned or if it was incorrectly handled or operated in the absence of these guidelines. The absence of guidelines for imports also poses a massive threat to national security. There is also the heightened risk of air accidents due to malfunctioning of drones, which can be dangerous to both life and property. Another peril of not having such regulations is the

vulnerability of these UAVs to hacking. For instance, just as malicious software and spyware can be placed on any number of mobile instruments procured from outside the country, the same can be easily implanted in drones. Without quality control, it is impossible to test the digital security mechanisms of these drones, thus giving operators no assurance of a secure link between operator and vehicle. The DGCA needs to urgently act on plugging these security gaps to prevent any untoward incidents from occurring.

Standard Operating Protocol for Incidents

While there are no guidelines in force, there has been no protocol formulated by authorities for incident management in the event of an accident. In 2015, for example, an unidentified man was spotted flying a drone close to the residence of the President (the Rashtrapati Bhavan) and the Indian Parliament.[16] The police, clearly in a confused state, launched an uncoordinated and ineffective response to the alarming situation. The man reportedly was confronted by a person from the media, after which he left on his own accord; he has not been identified since. Media reports say the Delhi Police has issued standard instructions to its personnel in this area in responding to similar situations,[17] making the Indira Gandhi International (IGI) Airport a no-fly zone and sanctioning police officers to shoot down any UAVs sighted in its vicinity.[18] However, this paper argues, while it is dangerous to allow drones to fly in the vicinity of an airport, there should be a better way to ground them rather than simply shooting them down.

In another such story, in 2015 in Bhopal,[19] UAVs bearing Hanuman idols flew over the city for a considerable amount of time without provoking a reaction from the police. The incident was not only a safety hazard but could also have sparked off religious tensions. An FIR was filed by an activist[20] with Madhya Pradesh Police on the issue, yet no

headway has been made in addressing the situation so far. An official from the MP Police claimed that a letter was sent to the DGCA requesting them to recommend a course of action;[21] this only shows the lack of clarity for the police. Madhya Pradesh Police now claims that they are in the process of independently forming Standard Operating Procedure (SOP) to deal with incidents such as this. What is worrying though is the lack of coherence and coordination on the part of authorities in reacting to such situations. Even now, there is a worrying absence of dialogue between regulators and enforcers in developing SOPs for addressing UAV-related situations in a manner that ensures the safety of the skies without hampering the use of these vehicles.

Surprisingly, potential operators and regulators have been reluctant to seek advice from the Armed Forces for the operation, maintenance and regulation of UAVs. The Armed Forces have been successfully operating drones for some years now and have gained considerable experience and expertise in not only flying these vehicles but also dealing with emergencies and contingencies. They have also instituted robust procedures to ensure the safe operation of drones even in harsh conditions and have accumulated knowledge in this regard. It seems wasteful that civilian authorities are not engaging the Armed Forces on tapping their vast repository to develop better informed policies on UAVs.

The Privacy Question

When it comes to UAVs, the question of privacy becomes an intricate problem, bringing with it the controversial debate of security versus privacy. Drones operated by non-governmental agencies pose a major threat to existing privacy laws. Most UAVs have constantly-transmitting cameras that often operate in high definition. Intended infringement of privacy is quite easy as it is, but drones also present the

case of unintended invasions. This aspect makes it more difficult to ascertain infringement of privacy under existing laws in India.

Drones present another interesting paradigm shift in the way questions of privacy are viewed. While visual infringement is often believed to be the only incursion on privacy when it comes to UAVs, they present a far more complicated issue considering that advancements in both sound recording and data capture enable a drone to be used for far more invasive snooping. A hovering UAV can be used to record sound from a room even at normal conversational levels. It can also be used as a network jammer to block wireless communication in an area. Given the strides in reducing drones to the size of a small bird, it has become easy to overhear private conversations and block all forms of wireless communication from an enclosed space.

The Indian government has so far made no attempt to address concerns of privacy infringement by drones. The Draft Guidelines of the DGCA includes a single line on the importance of privacy; it is vaguely worded and appears inadequate in tackling such an integral issue. The United States, for instance, had acknowledged the importance of the issue when former President Barack Obama published a memorandum calling on various American governmental agencies to explore solutions to the question of protecting privacy while allowing drones to operate freely. For its part, the Australian Parliament has also pondered the issue and has made a case for the application of existing laws to the situation. Australia being another common-law country, its model could be adapted for India effectively.

The Indian government is reportedly in the process of considering the revision of certain sections of the Information Technologies (IT) Act. The IT Act currently covers various questions of privacy and technology including concepts of data protection and distribution. The only other law that can be applied to this case is Article 21 of the Indian

Constitution, which covers the Right to Privacy. However, while these laws define the idea of privacy in India, they cannot be applied directly to the UAV case. The government needs to open a dialogue on defining certain parameters of privacy related to UAVs; otherwise, the prosecution of breaches of privacy could become more convoluted.

The second broad question that arises is the regulation of governmental agencies using drones for surveillance. Today, government agencies, including in India, are contemplating the use of drones for a range of activities from traffic monitoring to maintaining security during crowded events. Recently, the Mumbai Police used drones to conduct surveillance over processions during a major festival in the city.[22] This was meant to aid the police in maintaining the law and order situation at an event that gets too crowded for most conventional surveillance techniques to remain effective. The privacy considerations of such use of UAVs by law enforcement agencies become important. Do law enforcement agencies have a culture that encourages respect to privacy while using such technology that makes a breach convenient and almost untraceable?

This debate has gained popularity in the US over the last few years and is an integral part of the much larger discourse on the extent of surveillance law that enforcement agencies need to exercise to ensure security. A noteworthy point that holds credence is the concept of "reasonable" breach of privacy. As it operates, every UAV will take snapshots of certain areas as a surveillance mechanism–and these may be considered as a reasonable breach of privacy that is needed to maintain security. However, an amalgamation of snapshots of a certain area maps something called a "pattern of life", which refers to the routine behaviour of humans on a normal day. A drone will inevitably capture snapshots of areas over a vast period. How law enforcement agencies choose to view them is what determines whether they are conducting a reasonable or unreasonable breach of privacy. When

viewed as individual snapshots they may still be used to maintain law and order, but when viewed as an amalgamation or continuum of snapshots, they could be classified as an unreasonable breach of privacy.

Many of these debates highlight an underlying issue that drones will inevitably capture a vast spectrum of data during their operation. This simply cannot be prevented if they are to function effectively. Privacy can be respected or breached based on how the data is processed or examined. Therefore, a culture of privacy must be given emphasis when Indian law enforcement agencies use drones to conduct surveillance and engage in similar operations.

Terrorist Threat Management

With rapid advances in the variety of functions that a drone can undertake, there have been several instances of known terrorist organisations using them to carry out their activities. Policymaking needs to be robust in this sphere as well, to ensure that security agencies are prepared to deal with threats of this nature.

Worryingly, the ISIS has started using drones in their operations. Its fighters in Iraq recently used a drone as an explosive to attack Kurdish forces.[23] The drone was shot down by Kurdish forces, who initially believed it to be a surveillance drone, but realised when it exploded that it was embedded with most materials that would be required to make a conventional bomb. Terrorists can also use drones for a variety of purposes such as surveying security arrangements, jamming networks at integral locations, and even executing bombings, as seen in Iraq.[24]

In Delhi, the police has issued a circular banning paragliders and unmanned flying objects over the city's skies through the festive month of October, when massive crowds gather in public places and the risks of criminal activities and terror attacks are heightened.[25] This shows that

law enforcement agencies are aware of the risks posed by such objects when they are in the hands of criminals and terrorists. However, a blanket ban on them for a month does not appear to be the solution. Further, a vital question to be asked is, what will the police do in case of a violation of the ban? Does the city have the infrastructure to bring the drone down? Recent cases suggest that the answer is in the negative. The last time law enforcement agencies in Delhi tried to ground a flying drone, they did it by shooting at it from the ground. Sadly, this has been the best-case scenario so far, with police not able to ground drones in several incidents over the past few years. The police normally try to locate the operator of the drone to ground it but have not been able to do so otherwise.

In many places across the world, law enforcement agencies have started developing increasingly innovative techniques to bring down rogue drones. To start with, a background check or police verification mechanism like the ones used for gun licenses can be employed. While this might seem tough to implement on a large scale, it is necessity to stem proliferation. Agencies across the world have been working on equipment like nets, frequency jammer guns and anti-drone rays to bring down rogue drones. Indian security agencies also need to acquire such equipment. This will ensure that they do not have to resort to banning drones in order to deal with their potential security threats.

Air Traffic Management

Drones present a new dimension in the management of air traffic as they are neither as easy to track as conventional aircraft nor as easy to communicate with. The questions in this sphere are many. Can existing air traffic management infrastructure be used to manage the traffic of drones as well? Are the authorities equipped to monitor the movement and chart the flight paths of drones? Is there a need to track low-flying UAVs? If yes, how can this be done effectively?

In an extremely dangerous incident, an Air India flight almost collided with a UAV at Leh airport in 2014.[26] The Air Traffic Control (ATC) at Leh, operated by the Indian Air Force, had no information regarding the UAV that was flying close to the runway and undetected on radars. In another such incident, a drone flying very close to the IGI Airport in New Delhi[27] was seen by ATC personnel, unaided by binoculars or any other device. Investigators found that no radars had picked up the UAV, nor was any imaging found on their recording equipment. Authorities reported that the UAV was flying at about 1,500 metres above ground level, well within radar range. India, however, is not the only country that is grappling with this problem. Investigators in UK report of some 56 "near-miss" incidents involving UAVs in 2016 alone.[28] This makes it evident that a serious upgrade of current equipment and infrastructure that manages air traffic is essential.

Taking note of such issues, the Indian government has constituted a committee to ensure the smooth upgrade of ATC units to accommodate UAVs in the Indian airspace. The DGCA is working actively on this to come up with solutions that can be implemented simply by tweaking existing systems and equipment. Meanwhile, NASA, in collaboration with the Federal Aviation Administration (FAA) and certain private corporations, is developing a system that monitors the flight of drones and helps in collision avoidance. The device is called the Low Altitude Tracking and Avoidance System or the LATAS,[29] which is small in size and requires little resources. Having the potential to be used on a large scale to plug the deficit in traffic management infrastructure, LATAS is currently at the prototype stage and will have to go through testing for some years before becoming fully operational. Another concept currently still under development is a collision avoidance system for drones.[30] Essentially, this ensures that a drone can sense if an object is in front of it and is able to change its flight path to avoid the object without any intervention from the operator. While such technology already exists, it is directed at protecting commercial flights from UAVs. There

have been far few efforts at preventing collisions between UAVs. Such an event could also result in loss of property and pose a risk to human life. This aspect needs to be taken into consideration in the efforts at upgrading infrastructure.

Legal Liability

The draft DGCA Guidelines assigns the legal responsibility of UAVs on their operators. The assumption is that the operator would ensure that the vehicle is airworthy and is functioning as expected. However, this might not always be the case. Even though users should ideally be able to ascertain if their drone is functioning properly, this is an expectation that cannot realistically be met in all cases. Not every operator has the technical expertise to judge the condition of their UAV. In the event of an accident due to malfunctioning of the vehicle itself, it would be unfair to hold the operator responsible and carry out legal proceedings against them. With other such cases involving vehicular accidents, a third-party liability mechanism is used, limiting the liability of either party. Aspects of third-party liability have not been addressed in the DGCA circular. There will be a need for provisions to be made for third-party liability in case of drones. Third-party liability will also give way to third-party insurance mechanisms, which will make it easier to resolve liability cases.

Moreover, it might be argued that the Rome Convention of 1952 on Damage Caused by Foreign Aircraft to Third Parties on the Surface could be held applicable even to drones. India never ratified the Rome Convention after signing it in 1955. While this Convention was meant to apply to questions of legal liability for damage caused by regular aircraft, the same principles could be adapted for drones. The Convention, interestingly, limits the liability for unintentional damage for aircraft, but the liability for intentional damage is unlimited. This principle could be incorporated into legal provisions made for UAV operation with the parameters adapted for the same.

Issues of Trespass

Another aspect of legal liability is the rules governing trespass of private property by drones. Important questions arise relating to factors that will determine whether the operation of a drone over private property constitutes a case of trespassing. This is a question that has not been addressed in the DGCA circular. At what point can a citizen claim a case of nuisance on private property attributable to drone operations?

British common law prescribed the Latin dictum "ad coelum et ad inferos", literally translating as "to the heavens and hell", to describe the extent of private property underground and in the sky. However, with the advancements made in aviation, society took cognizance of the fact that there was in fact a limit to the extent of private property both above and below ground. Yet, there is no legislation that exists that definitively ascertains this extent above the ground.

A noteworthy case that is of relevance to these questions is that of United States v Causby in the US Supreme Court in 1946. The Causbys' chickens were dying of fright caused by aircraft of the United States Air Force flying at a low height above the Causby farm. This had caused the Causbys direct and measurable monetary damage for which they sued the US government. The Supreme Court, however, noted that the airspace above a minimum safe altitude of flight was essentially "public highway and part of the public domain", which holds relevance for the drone scenario as well. What is clear is that parameters for determining the extent of private "airspace" over any private property must be established to avoid Causby-like cases.[31]

One such parameter could be a minimum flying height. For drones of various sizes, a minimum height of flight over private property could be ascertained, essentially establishing the "airspace" of every private property. This method must take into consideration various

complications while calculating an airspace, such as whether it is calculated from ground level or from the top of a constructed property. Given the current and predicted future of technological advancements, deciding on a suitable height will ensure that drones will not be a nuisance or cause breach of privacy on private property.

Another parameter that could be used to determine trespass is the intent of the drone operator. While this might be the toughest to judge, it does provide a moral basis for ascertaining a case of trespass. Cases where such breach of privacy was intentional can be considered as clear cases of trespass.

GLOBAL GOVERNANCE OF DRONES

Given the growing demand for drones especially in the non-military sector, the need for policies and regulations has become more urgent. Thousands of drones and UAVs are already in use in many developed countries and yet governments and multilateral organisations have not developed a framework regulating this sector. The UAV landscape is changing much faster than the governments' ability to keep up with the changes. The net result is a policy void.

Global Governance

Globally, rules and regulations around the use of drones are still in its infancy. Even though India is still a small player as compared to the US and China, New Delhi could take the initiative in framing rules of global governance partly because the evolution of drone technology could have serious security implications for India, but equally because it is better for India to lead the initiative and protect its interests.[32]

So far, at the multilateral level, the International Civil Aviation Organisation (ICAO) is the lead platform for framing rules of the road

for drone operations. Although it began its work on UAVs back in 2007, the first set of rules in the form of Circular 328 was issued only in 2011. Subsequently, it developed the Remotely Piloted Aircraft Systems (RPAS) Manual. Circular 328 became the first step towards regulating the sector. It called on "states to provide comments, 'particularly with respect to its [drone] application and usefulness'" with the aim of developing 'the fundamental international regulatory framework through Standards and Recommended Practices (SARPs), with supporting Procedures for Air Navigation Services (PANS) and guidance material, to underpin routine operation of UAS throughout the world in a safe, harmonized and seamless manner comparable to that of manned operations.'"[33] However, the more comprehensive set of standards and regulations is set to be promulgated in 2018. Currently, the ICAO in addition to the Circular has amended three UAS-related amendments to its Annexes – Amendment 13 to Annex 13: Defining accident to include reference to unmanned aircraft (March 2010), Amendment 6 to Annex 7: Registration and identification requirements for remotely piloted aircraft (April 2012) and Amendment 43 to Annex 2: High level requirements relating to remotely piloted aircraft systems (April 2012). The ICAO must also look at best practices from other countries that could be added to the basket of norms and standards that might evolve in a gradual manner.

A handful of agencies around the world have begun contemplating on the regulatory aspects of drone operations.[34] Recognising the enormous growth potential, the European Aviation Safety Agency (EASA) has been tasked by the European Commission to frame regulations for drone operations.[35] The EASA published a comprehensive proposal in May 2017 covering the technical and operational aspects of operating drones.[36] According to the proposal, all UAVs above 250 gm need to be registered. The EASA had sought comments and feedback from all interested parties and it will submit a final version of the proposal to the European Commission end of 2017

before it is formalised into a law. The more dynamic aspect of the proposal is that it has been developed in consultation with members of drone industry, UAV operators, aviation representatives and aero modelling associations, in addition to all the EASA member states. Even as EASA firms up the proposal into a law, it is the responsibility of individual member countries to set more operational restrictions such as air space limitations, in terms of, for instance, how many kilometres above the ground they can operate. Different European countries have different regulations – for instance, one can fly drones commercially in Switzerland if line-of-sight can be ensured, within certain altitude limitations and not flying near protected areas such as airports. On the other hand, France has somewhat more restrictive regulations in place and it is mandated that any drone operation over the city of Paris needs to be authorised by aviation authorities.

US Regulations

The US has by far the most commercial-friendly regulations in place. The New Small UAS Rule (107) of the Federal Aviation Administration (FAA) that came into existence in August 2016 regulates most operations of drones, especially those that fall under commercial or work purposes.[37] Part 107 rule specifies that an operator can apply for a waiver of Part 107 rule if the drone weighs less than 55 lbs, however, the waiver application must specifically state how the operator plans to safely conduct the operation, including emergency risk mitigation strategies. Drones weighing 0.55 lbs to 55 lbs must be registered with the FAA and most significantly, the UAV must be within the visual line-of-sight. The line-of-sight principle is not particularly pleasing to the industry and it is of the view that rules could become further relaxed once the sector reaches full automation. The FAA is believed to have relaxed the rules for drone operations in the commercial sector keeping in mind that the drone applications are estimated to generate an additional US$82 bn to the US economy.[38] Many industry giants including DJI Innovations (China

headquartered (Dajiang), the world's largest drone manufacturer, Pix4D attest to this potential. For UAV operations other than for work or commercial purposes, and specifically for recreational activities and hobbies, there are specific laws such as Public Law 112-95 Section 336 which states that UAVs must operate within visual line-of-sight, give way to manned aircraft, provide advance notification to the airport and air traffic control tower, when flying within five miles of an airport, and also the UAV must not weigh more than 55 lbs.[39]

Regulations in Australia

Australia was one of the first few countries to establish a regulatory framework in the area of drones, with the first set of regulations coming out as early as in 2002.[40] The Australian Civil Aviation Safety Authority has the primary responsibility of ensuring safety and regulating drone operations under different categories such as drone operations for fun, hobbies or commercial ventures.[41] New rules regulating drone operations were issued in September 2016, which have been framed particularly from a risk-reduction and safety perspective.[42] The new regulations accordingly are meant to be less restrictive from a legal and regulatory perspective, thereby facilitating low-risk operations. The new rules also exempt small commercial drone operators from paying the US$1,400 in regulatory fees as well as avoid the lengthy documentation and paper work. Also, property holders are allowed to operate drones up to 25 kg on their properties without any approval. There are still grey areas that require more clarity in the regulation. For instance, a drone operation that does not seek any "commercial gain" can operate without any certification but the concept of "commercial gain" can be interpreted in multiple ways. If an operator is using UAVs to advertise a product or if an operator seeks to shoot videos and upload onto YouTube, these may not see a direct commercial benefit but they go to publicise a certain industry or an activity.[43]

Japan's Drone Regulations

Japan came up with its first set of regulations only after a serious incident where a small drone was found on the roof of the prime minister's office building in Tokyo in April 2015.[44] The incident brought about the urgency to regulate drone use and, accordingly, the ruling Liberal Democratic Party (LDP) proposed a bill to the Diet (Japanese Parliament) in June 2015. A separate bill, which proposed amendments to the Aviation Act was submitted in July 2015 and both the bills were passed in the Diet subsequently.[45] Under the new regulations, an operator can fly a UAV only after obtaining permission from the Ministry of Land, Infrastructure and Transportation (MLIT) where there is air traffic such as airports and other approach areas, or areas above 150 metres. There are also restrictions for drone use in the hours of dawn and dusk, in addition to the requirement to maintain more than 30 metres of distance from people and objects. Violations are subjected to a fine of upto (US$4,000 approximate) 500,000 yen.[46] Japan's regulations relating to drones have been drawn, keeping in view the function of drones in the commercial context. Nevertheless, terrorism and other security-related concerns have pushed for stronger regulations for drones for hobby and recreational activities.

China's Regulatory Framework

China has in recent years emerged as a major hub for manufacturing of drones. Some of the industry majors in drones such as DJI (Dajiang) Innovations, Zero Zero Robotics, Yuneec, and Hubsan belong to China. Five out of 11 global venture-capital funded drone companies are in China and foreign companies are beginning to have a larger presence in the country.[47] China's use of drones for commercial purposes including in agriculture is likely to pick up greater momentum, even as the legal and regulatory architecture is yet to be clearly defined. Also, there are safety issues that need to be dealt with. In December 2015, the online

commercial giant Alibaba's drone out on a test crashed into a landing military jet, demonstrating the safety issues that are far from settled.[48]

Current regulations, as they exist today, differ across regions– Beijing and Shanghai appear to have far stricter policies regarding when and where drones can be flown – given the densely populated nature of these cities. Regulations also make a distinction between small consumer drones and large commercial-use drones. Following a series of accidents involving drones, the Civil Aviation Administration of China (CAAC) began putting in place stricter laws in June 2017 that mandate civilian drones above a certain size to be registered under real names in order to strengthen the safety measures associated with use of drones.[49] China's lead role in the drone market and the potential for large-scale use of drones in commercial and non-commercial sectors are significant but the regulatory and legal framework are yet to take firm roots.

CONCLUSION

There are various questions concerning ethics, regulation and implementation that exist in the domain of drones. These questions need to be carefully addressed, keeping in mind the extant legal and moral principles and adapting them to the rapid technological advances to create an effective governance regime for UAVs in India. India must also examine prevailing policy mechanisms in other countries to adopt their best practices as it formalises its regulatory framework. However, a point to be underlined is that guidelines alone are not sufficient; key is ensuring implementation and compliance. This would essentially mean that guidelines and circulars issued by governments and multilateral agencies like ICAO need to be converted into legal and policy instruments that would have a binding effect on governments. However, standards and norms of responsible behaviour relating to drones are essential first steps in this regard. ORF

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