CONCEPT OF OPERATIONS FOR UAS IN INDIA v2.0

For questions and feedback, please reach out to pushpaka@ispirt.in

Background

1. Civil aviation has, traditionally, been based on the notion of a pilot operating the aircraft from within the aircraft itself and more often than not with passengers on board. Rapid technological innovations have enabled pilotless aircraft which can be designed for specific applications that require precision or long duration which have been considered near impossible hitherto. These aircraft also enable applications considered dull, dirty or dangerous, in other words, tasks that entail monotony or hazard for the pilot of a manned aircraft. Such pilotless aircraft make use of ground based or pre-programmed automatic controllers to manoeuvre the aircraft in flight and are generically termed as drones, although a better term is Unmanned Aircraft Systems (UAS).

2. Traditionally, drones had been limited to military use due to high costs and technical sophistication. However, there is a far broader scope for UAS use, including, inter alia, commercial, scientific and security applications. These potential applications have driven innovations in UAS technology; especially in areas of control, navigation and energy storage; which have provided consumers with suitably small-sized cutting-edge products that are easy to operate and maintain at affordable prices. Today, due to economies of scale, consumers can purchase drones for less than a thousand rupees. Even sophisticated drones with advanced cameras and sensors are available for under fifty thousand rupees. On the other end of the spectrum, large aircraft manufacturers such as Boeing and Airbus, are spending billions of dollars developing pilotless aircraft considered safe enough for long-range intercontinental flights by passengers.

3. Given that the spectrum of pilotless aircraft ranges from a small toy weighing a few tens of grams to airplanes weighing several hundreds of thousands of tonnes, it becomes near impossible to be able to meaningfully regulate all of them with the same rules or standards. In order to overcome this formidable challenge, the International Civil Aviation Organisation has unambiguously categorised pilotless aircraft and associated systems into two broad categories as follows: -

3.1 Unmanned Aircraft (UA) – an unmanned aircraft which is not permitted to operate alongside manned aircraft by airspace restrictions.

3.2 Remotely Piloted Aircraft (RPA) - an unmanned aircraft, actively piloted from a remote pilot station, which is allowed to use the same airspace as manned aircraft subject to meeting the same safety standards as manned aircraft. For the ease of understanding, although having no pilot onboard, RPAs act like and are treated like aircraft operated by onboard pilots.

4. The distinction between UAS and RPAS assumes even greater significance when the regulatory principles for conventional manned aviation (depending more on aeronautical/ mechanical engineering and larger systems) are applied to the rapidly evolving technology for UAS (depending more on robotics and information technology and miniaturisation). The specific significance pertains to the time between design and deployment of any machine and the associated costs. Whilst the design cycle may spread over two decades or more in the case of manned aircraft, UAS may hit obsolescence in even two years. Similarly, the development and certification costs of conventional aircraft may run into billions of dollars but the cost from design to deployment may be achieved within a few thousand dollars for UAS.

5. It is therefore evident that the regulations for the two categories need to be substantially different and based on the intended applications and associated risks for each category. In this context it is safe to state that the common usage of the term 'drone(s)' is mostly indicative of UAS and not RPAS.

Applications of UAS

6. UAS offer immense opportunities for economic growth and employment generation across a very wide range of applications based on their size and design. Whilst RPAS are currently being used exclusively for research or for governmental purposes, significant economic activity using UAS has already attained acceptance in many countries.

7. The main civil applications of UAS which are already well established are as follows:

7.1 Aerial photography & video – With a drone that is equipped with an HD camera, one can take fascinating photos and shoot footage of great quality from the sky. Often the live video is used to provide coverage to important events, especially sports and entertainment events and/ or for promoting tourism.

7.2 Surveying & Mapping (GIS) – Using multi-spectral cameras and laser scanners, drones are able to create high-quality 3-D maps. Therefore, they have applications in various areas, including remote sensing, surveying & mapping, photogrammetry, precision agriculture, and more.

7.3 Agricultural services – Drones are very useful for enhancing agricultural productivity through applications like crop dusting, pest control, seeding, survey, etc. Drones can be programmed to provide accurate amounts of pesticide or fertilizer, significantly improving not only the crop yield but also the quality of produce.

7.4 Inspections – Many systems such as power lines, railway lines, wind turbines, and pipelines can be checked by drones. This can avoid the hassle and safety issues involved with sending a human to check them. Inspection of ships and larger aircraft, where human access is time consuming or impossible, is also being undertaken by drones.

7.5 Surveillance – Drones allow recording and monitoring from the sky, and therefore, they are suitable for monitoring sensitive infrastructure/ areas, large factories, public events, or any activities of concern to law-enforcement with fewer personnel on the ground. A great tool for the police to monitor a large area with a flying camera from overhead!

7.6 Unmanned cargo system – Drones also serve in delivery of lightweight packages and bundles of all sorts. This method enables safe, environmentally friendly and fast transport of goods by air.

7.7 Search and rescue – Drones are very useful in search and rescue operations as they can safely enter a space that humans cannot. For example, they are used in firefighting to determine the amount of the certain gases in air (CO, CO_2 etc.) using special measuring equipment.

7.8 Security – Many authorities use drones to protect people. For instance, they help coordinate a variety of security operations and can preserve evidence alike. They are also used for specific security applications such as coast line inspection, preventive border surveillance, drug control, anti-terrorism operations, avalanche prediction and control, hurricane monitoring, forest fires prevention surveillance etc.

7.9 Science & research– Drones help scientists in research work to observe different occurrences in nature or a particular environment from the sky. For example, drones are used to document archaeological excavations or in glacier surveillance and more. They are also a very useful tool in STEM activities in education.

7.10 Disaster Relief and Disease Control - Drones are especially useful in undertaking surveys of disaster zones and planning and monitoring of relief operations in various emergency situations. Similarly, spraying for control of larvae/ mosquitoes or similar disease control agents can also be effectively undertaken for disease control especially in public health crises such as the COVID-19 pandemic.

7.11 Drone displays – Drone swarms are finding increasing use for aerial displays at important events.

8. The key common element in all these established applications is that they are most effectively undertaken using rotary wing drones. Further, the bulk of these applications do not need very large sized UAS, although certain applications such as logistics and agricultural or medicinal sprays could benefit from larger UAS based on the area to be covered.

Guiding Principles for Regulation of the Operating Environment

9. Efficiency

9.1 The economic implications of commercial drone use are undeniable. The FICCI Committee on Drones has said that India's Drone & Counter-Drone market potential up to 2030 is cumulatively estimated to be around INR 300,000 crore (approx. US$ 40 billion) with Defence and Homeland Security accounting for ~50 per cent of it[1]. The major initial applications are expected to be in agriculture and survey sectors, besides security. Due to the ability to cover large areas, the use of drones in precision agriculture is anticipated to effectively feed and hydrate plants while also limiting exposure to diseases or indiscriminate use of pesticides. Similarly, use of drones for surveys is expected to yield significant benefits in infrastructure project design and management.

9.2 On a macroeconomic scale, the integration of UAS could create a large number of jobs. Jobs created from commercial drone use will consist primarily of manufacturing jobs, drone operators and support services such as maintenance and logistics. Likewise, the government will benefit from tax windfalls, stemming from increased economic activity.

9.3 However, all stakeholders viz the drone industry, manned aviation, regulators and law enforcement, etc. need to evolve and embrace necessary fundamental changes for this sunrise sector of the economy to play out its potential. Specifically, the regulatory regime needs to be designed with drones in mind and not lean too heavily on traditional manned aviation. Further, regulations need to be simple with

[1] https://ficci.in/pressrelease-page.asp?nid=4062

minimal compliance costs in order to provide a fillip to the industry and attract investments.

9.4 Simpler compliance also provides benefits in terms of encouraging legitimate use rather than operators resorting to illegal imports which will, in turn, prove a challenge to compliance. Additionally, since the industry is evolving very rapidly technologically, it is likely to be some time before more implementable compliance standards are developed.

9.5 Efficiency in regulations will enable development of market capacity to encourage fresh investments and further innovations. It will also enable reduced gestation period for SMEs and even individual service providers such as videographers who are possibly at the bottom of the industry's economic pyramid.

10. Safety

10.1 India is a signatory of the Convention on International Civil Aviation (also known as Chicago Convention) and is therefore required to undertake steps for implementation of the provisions of this Convention.

10.2 Article 8 of the Chicago Convention entitled "Pilotless aircraft" provides that:

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

10.3 The Convention mandates that an aircraft shall be operated in such a manner as to minimize safety risks to persons, property or other aircraft. These safety risks relate to all aircraft operations irrespective of the type of aircraft or purpose of the operation. Thus, there is a need to regulate even UAS operations in a manner such that risk to safety or security of people and assets is contained.

10.4 In order for UAS to be widely accepted, they will have to be integrated into the existing aviation system without negatively affecting manned aviation (e.g. safety or capacity reduction). It is, therefore, essential to ensure that the UAS intended to operate into non-segregated airspace, meet the operational safety criteria applicable to manned aircraft.

10.5 If this cannot be achieved (e.g. due to intrinsic limitations of UAS design), the UAS needs to be accommodated by being restricted to specific conditions or areas e.g. visual line-of-sight (VLOS), segregated airspace (i.e. airspace outside the operational ambit of manned aircraft) or away from heavily populated areas.

10.6 In the unforgiving world of aviation safety, the opportunity for low-cost and rapid innovation afforded by drones can lead to prohibitive costs in the form of damage to manned aircraft and loss of lives. Therefore, safety demands that a phased approach be adopted in enabling large scale drone operations, even at the cost of artificially slowing down the growth of the drone industry. Infact, the current state of India's drone industry can arguably be attributed to an over cautious approach till the recent past. Justifiably, the past approach needs to be shed but safety demands dictate a measured and nuanced approach, taking into account the many lessons learnt during the growth of manned aviation.

10.7 Drones should be integrated into the existing aviation system in a safe and risk-proportionate manner and this integration should foster an innovative and competitive drone industry, creating jobs and growth, in particular for MSMEs. The proposed regulatory framework should set a level of safety and of environmental protection acceptable to the society and offer enough flexibility for the new industry to evolve, innovate and mature. Therefore the exercise is not simply transposing the system put in place for manned aviation but creating one that is proportionate, progressive and risk based; and the rules must express objectives that will be complemented by industry standards.

11. Security

11.1 Another significant challenge for regulating drone use is the security conundrum arising from illegitimate use of drones. Whilst rogue operatives will always pose a challenge to every technological advancement, given the long history of sub-conventional warfare in the form of terrorism from particulary hostile neighbours, India has to factor this challenge more critically.

11.2 Ideally, legitimate use of any technology should not be restricted especially if it has significant economic benefits as is the case of the drone industry. However, in India's context, a secondary impact of drone proliferation would be the potential saturation of our security establishment in differentiating between the 'good' and the 'bad' actors. Until such time that suitable technological solutions are not put in place to safeguard vital national infrastructure, more rudimentary controls in the form of limiting legitimate use of drones to categories that are easily identified and incapable of significant harm may need to be adopted.

11.3 Protection of other public interests such as personal privacy and security entailed by drone operations will also need to be addressed. The regulatory framework would eventually need to include provisions to reduce those risks.

12. Infrastructure Issues

12.1 Considering the expected density of UAS, conventional Air Traffic Management (ATM) techniques cannot be considered sufficient for management of Beyond Visual Line of Sight (BVLOS) UAS operations and integration of drones into non-segregated airspace. Since the UAS will not have a pilot to lookout and maintain separation from terrain or traffic and the UAS cannot directly respond to Air Traffic Control (ATC) inputs, new technologies requiring high telecom bandwidth are required. Telecom bandwidth requirement would also increase if the drone has to be actively controlled throughout its flight by the remote pilot. Thus telecom bandwidth and suitable networks are likely to be a key infrastructure requirement for effective UAS operations.

12.2 Further, considering the small size of the drones, traditional radar technologies are likely to prove inadequate for traffic monitoring. Instead global developments indicate a shift towards the UAS transmitting its ID and velocity vector for traffic management – another requirement for bandwidth. However, even such technologies need support of automatic detect and avoid technologies which again demand bandwidth.

12.3 Currently, there is negligible development of Unmanned Traffic Management (UTM) concepts or infrastructure in India and a significant amount of further research and strengthening of telecom infrastructure to ensure network availability in the airspace of interest would be needed.

12.4 Also, the development of the drone market and related technologies need to be carefully monitored and the planning adapted.

12.5 Finally the harmonization of regulations and availability of telecom spectrum is fundamental to the success of drones.

12.6 Other infrastructure demands that can be envisaged would pertain to drone-ports for the arrival and departure of especially larger drones even if they are not flying alongside manned aircraft.

12.7 Finally, in dense urban environments with multiple high-rise buildings, availability of adequate public routes where drone traffic does not pose noise or safety hazards to uninvolved public is likely to be another key infrastructure constraint.

Suggested Concept of Operations

13. Given the significant economic benefits, it is imperative that notwithstanding the challenges arising from safety and security concerns, India's drone industry is allowed to 'take-off'. However, any attempt to rush headlong into permitting complicated drone operations especially in non-segregated airspace may lead to catastrophes which may actually force a policy regression thus harming the fledgling domestic drone industry.

14. It would, therefore, be prudent to have an incremental approach in drone regulations rather than proposing comprehensive regulations for the complete range of drone operations right from the start. This incremental or graduated approach is based on an identification of the needs and associated risks of each category of operation based on the guiding principles identified earlier. In fact, the concept of the graduated approach is a logical extension of ICAO's segregation of unmanned aircraft into UAS and RPAS. The categories of UAS in the graduated approach should be the basis for defining the 'rules of business' or operational boundaries which enable safe and efficient operations for the applications of drones, both current and potential.

15. Any regulation, especially ones pertaining to aviation, needs to regulate or balance the two seemingly divergent concepts of safety and efficiency. The most efficient operating environment would be where there are no rules to be followed whilst the other end of the spectrum would be so tilted in the favour of safety that it follows the maxim that 'the safest ships are the ones in the harbour.' Accordingly, the modern principle is to follow a risk based approach which, stated simply, means that the impact of an operational hazard is multiplied by the likelihood of its occurrence to reach a quantifiable risk which is then assessed for its acceptability. Regulations following the risk based approach are designed to permit operations at this edge of acceptable risk.

16. The suggested categories based on this technique are elaborated in the subsequent paragraphs.

17. Category A (Least Risk).

The first category comprises drone operations that pose the least risk and require the least infrastructure. A typical example of these least risk operations is the use of small drones for photography or videography. The operational boundaries could be defined as follows:-

17.1 Operations in Visual Line of Sight (VLOS) only

17.2 Operations at a safe distance away from people, animals, infrastructure and aerodromes

17.3 Operations in segregated airspace only till a specified maximum height above ground level (AGL)

17.4 The drone capability is limited by design within specific performance limitations such as mass, speed, ceiling, rate of climb, rate of descent etc

18. Category B (Minimal Risk).

This category comprises drone operations that would be unlikely to result in a fatality or cause serious injury to persons or infrastructure on the ground. An example of such operations could be use of small drones for survey or agricultural purposes. These operations would be subject to limited regulatory restrictions that would be required to protect other airspace users and life on ground. The operational boundaries could be defined as follows:-

18.1 Operations by a qualified remote pilot only

18.2 Operations in VLOS or Extended VLOS (EVLOS) only. EVLOS is attained by means of additional observers in touch with the controller or observation systems providing adequate situational awareness

18.3 Operations at a safe distance away from people, animals, buildings and aerodromes. However, safety margins need to be increased and/ or operations need to be away from densely populated areas

18.4 Operations in segregated airspace only till a specified maximum height AGL, which could be more than the least risk category

18.5 Operations not involving carriage of dangerous goods or articles

18.6 Operations using drones that have mandatory identification features

18.7 The drone capability is more than the Category A but is still limited by design within specific performance limitations such as mass, speed, ceiling, rate of climb, rate of descent etc.

18.8 Operations only in fair weather conditions and away from security sensitive areas till establishment of adequate UTM infrastructure.

19. Category C (Intermediate Risk).

These are operations associated with a higher risk such as operations utilizing a larger and/or heavier aircraft with more payload capacity and with the potential to cause fatality or injury to persons on the ground or other airspace users. However, in order to limit safety challenges for manned aircraft, operations continue to be in segregated airspace. An example of such operations would be BVLOS operations in segregated airspace with limits on all up weight of the drone. Authorisation of such operations will require a risk assessment that will lead to an Operations Authorisation with specific limitations adapted to the operation. Operations in this category would require more stringent regulatory requirements with a focus on operational limitations such as payload, pilot qualifications, the establishment of airspace restrictions, altitudes, airspeed, proximity to aerodromes and congested/populated areas. The operational limitations would need to include:-

19.1 Operations by a trained remote pilot only

19.2 Operations at a safe distance away from people, animals, buildings and aerodromes. However, safety margins need to be increased and/ or operations need to be away from dense population areas based on the specific risk assessment

19.3 Operations in segregated airspace only till a specified maximum height AGL

19.4 Operations using drones that have mandatory safety, identification and tracking features conforming to specified standards

19.5 The drone capability is significant but is still limited by design within specific performance limitations such as mass, speed, ceiling, rate of climb, rate of descent etc.

19.6 Operations only subject to availability of adequate UTM infrastructure.

20. Category D (Maximum Permissible Risk).

These would include the more advanced applications of drones with negligible restrictions on size, the area or complexity of operation or use of airspace. This category of operations would include, with appropriate mitigations, BVLOS operations within controlled airspace. Such operations would need to conform to well researched/ established design characteristics that would assure the desired level of safety. These operations would require significant risk mitigation measures, for example:

20.1 Operators to have an adequate management structure to ensure safe operations

20.2 Licensed remote pilots who are issued licences after successfully completing practical training requirements, passing knowledge tests and meeting specific medical standards and age requirements

20.3 UAS will need to be maintained in a safe state for flight and be subject to design standards or other airworthiness certifications

20.4 The aircraft may need to be marked and registered and be able to tracked continually

20.5 Operational rules applicable to this category of operations would be extensive

21. All successful global regulations have followed an incremental risk-based approach to drone regulations. In fact, ICAO had adopted the European concept of graded regulations in 2017 and even published a toolkit[2] to help nations develop incremental regulations. The ICAO approach also mandates that UAS intended to operate in airspace meant for manned aircraft should also meet the safety and operational standards applicable to manned aircraft.

Suggested Implementation

22. Implementation Schedule.

The suggested approach for India, based on an incremental risk-based technique, should fall broadly under the following steps: -

[2] https://www.icao.int/safety/UA/UASToolkit/Pages/default.aspx

22.1 **Short Term**. Define rules for permitting operations in Category A and Category B categories. These categories of drone operations should, therefore, not require any specific authorisation by the government for the flight but should only be mandated to stay within defined boundaries for the operation. This phase is already underway in some ways but needs to be steered better with a clearer vision based on the concepts stated heretofore.

22.2 **Medium Term**. Develop functional UTM systems to permit Category C operations in segregated airspace. Alongside, actively pursue steps for laying down standards for the design of advanced drones and integration of UTM infrastructure with established ATM procedures. Hold public consultations and publish policy documents for enabling the long term integration of drones into the complete airspace. This is expected to be attained within the next three years.

22.3 **Long Term**. Establish the infrastructure and standards for enabling the full range of UAS operations including air taxi, large scale cargo and passenger services. This phase would be after the Category C operations have stabilised and requisite infrastructure has come up.

23. Implementation Recommendations

In order to achieve the earliest operationalisation of drone operations, albeit limited, it is recommended that the short term measures at Para 22.1 above are adopted at the earliest. Permitting drone operations in the Category A and Category B categories would provide adequate opportunity for the bulk of the current drone applications listed at Para 7 above albeit with some restrictions. Equally, this approach would provide the necessary opportunity for UAS operations to kickstart without compromising more pressing requirements of safety or security. It will also provide opportunities for development of efficient regulations and necessary infrastructure for the more complex applications having a higher bearing on safety. Most importantly, it will help build up market capacity for better investments into necessary research and development essential for developing better drones and requisite infrastructure to truly realise the potential of the drone industry.

Operational Limits

24. The changes in government policy over the last year have been significantly aligned with the requirements for enabling Category A and B operations although it is not unambiguously evident whether the changes have been brought in as part of a long term plan or are purely serendipitous. At the same time, unless the inherent risk

associated with UAS operations is appropriately managed, it may not be out of place to expect a strong policy backlash following even a few incidents or accidents involving drones. Notwithstanding, the key takeaway from the recent policy changes is that they are broadly in consonance with the roadmap proposed in this document. A few key issues in terms of clearly stipulating operational boundaries need to be further articulated so as to attain the desired level of risk management.

25. Category A

In view of the foregoing approach, the operational limits of the Category A for India are recommended to be defined as follows:

25.1 Using a drone with a gross mass of 2 kg or less on takeoff and throughout the duration of each operation under this category, including all items that are on board or otherwise attached to the aircraft; and

25.2 the drone is designed to minimise the chances of injury to any human being in case of accidental collision; and

25.3 the drone is operated at a maximum horizontal distance of 300m and always within the visual line-of-sight of the person operating the drone; and

25.4 the drone is operated at or below 30 m (100 ft) above ground level (AGL) by day only; and

25.5 the drone is operated at a safe distance from a person or animal not directly associated with the operation of the UAS; and

25.6 the drone is not operated in a prohibited or restricted area; and

25.7 the drone is not operated in an airspace notified for use by manned aircraft without prior approval of the controlling authority for such airspace; and

25.8 the drone is used only for hobby flying or photography/ videography.

26. Category B

The operational limits of Category B are defined as follows:

26.1 Using a drone with a gross mass of 25 kg or less on takeoff and throughout the duration of each operation under this category, including all items that are on board or otherwise attached to the aircraft; and

26.2 the drone uses primarily vertical axis rotors to generate its propulsion; and

26.3 the drone is designed to minimise the chances of injury to any human being in case of accidental collision; and

26.4 the drone is operated by a remote pilot authorised for the operation; and

26.5 the drone is operated at a maximum horizontal distance of 1000m always within the visual line-of-sight or enhanced visual line-of-sight of the remote pilot operating the drone; and

26.6 the drone is operated at or below 45 m (150 ft) above ground level (AGL) by day only; and

26.7 the drone is operated in suitable weather conditions that do not pose a hazard to the drone operation; and

26.8 the drone is not operated at a safe distance away from people, animals, buildings and aerodromes; and

26.9 the drone is not involved in the carriage of any dangerous goods; and

26.10 the drone is not involved in the carriage of any parcel or jettisonable load in excess of 5 kgs; and

26.11 the drone is not operated in a prohibited or restricted area; and

26.12 the drone is not operated in an airspace notified for use by manned aircraft without prior approval of the controlling authority for such airspace; and

26.13 the remote pilot is able to access web-based updates on any flying restrictions that may have been imposed over the intended area of operations before commencing the flight; and

26.14 the drone is not operated within 25 kms of India's international borders or 5 kms of India's coastline without the prior sanction of the appropriate law enforcement authority.

27. Category C and D

Operational Limits for Category C and D would be defined based on the realisation of technological solutions necessary for safety and adequate traffic management. These limits would also need to address the availability of drone-ports and routes. The key technological challenges that need to be addressed in this context and which should become a key focus of government aided research and development are covered in the following paragraphs.

Key Enablers

28. UTM Systems.

28.1 The ATM/ ANS (Air Navigation Services) requirements for managing safe BVLOS operations as also safe separation from manned aircraft are a key challenge. Several concerted efforts are underway globally to address these issues. However, unless radically new concepts emerge, there appears to be convergence on several key aspects :

28.1.1 Each UAS transmits a unique remote ID with a geo tracking feature.

28.1.2 Reliable detect and avoid systems onboard drones employed for BVLOS operations.

28.1.3 Having a separate Unmanned Traffic Management System for Very Low Level segregated airspace accommodating exclusive drone traffic.

28.1.4 UAS in non-segregated controlled airspace, adhering to manned aircraft standards and being under active control of remote pilots able to comply with ATS instructions.

28.2 India will need to not only develop further on these concepts but also dedicate suitable research and development effort for these solutions, failing which BVLOS flights are unlikely to progress beyond experimental or showcase events.

28.3 Another key area of research would need to be focussed on the network infrastructure required to support UTM. The network would need to account for the fact that it will have to be focussed in very low level airspace which has significant impediments to range and is susceptible to transmission distortions. There are also going to be the challenges of high volumes of data transmitted across substantially similar equipment and so interference or signal fading may become an issue of concern especially affecting network reliability. Reliability would also be more critical as the operating environment would be significantly more dynamic than, say, the mobile networks where the safety implications are less severe.

29. Design and Manufacturing.

29.1 The Directorate General of Civil Aviation (DGCA), assisted by the Quality Council of India (QCI) has recently specified manufacturing standards. However, arguably it needs to publish distinct equipment and design standards for approval of drones in the above two categories. The height and geo-fencing restrictions should also be mandated to be incorporated via firmware or other means in these standards, that is to say, that the drones should be incapable of infringing these stipulated limits by design.

29.2 Manufacturers of drones, domestic or foreign, are required to prove that the drones conform to all the stipulated design and equipment standards. However, there are apprehensions regarding the testing processes and availability of testing agencies. Further, manufacturers should be accountable in case of any manufacturing or design defects that lead to any infringement of the airspace boundary limits for each category.

29.3 Manufacturers should also be required to imprint a unique ID on every drone to ensure traceability of the drone. Manufacturers and traders should also be required to maintain a record of every transaction of drones or components in order to ensure traceability given our security paradigm.

29.4 There would also be the need for government aid in researching in the following areas to make the Indian UAS fulfill all operational aspirations and also be able to compete globally: -

29.4.1 Lightweight materials of requisite strength

29.4.2 Manufacturing processes for desired finish and finesse

29.4.3 Aerodynamic designs

29.4.4 Light-weight long-lasting fast charging batteries

29.4.5 Tamper proofing of hardware and software etc.

30. Remote Pilot Authorisation

30.1 There should be no formal training requirements for Category A operations. Rather persons desirous of undertaking such operations should only be required to self-brief based on an operating guide which should be an essential part of the UAS package.

30.2 Persons desirous of operating drones in Category B should be required to obtain authorisation after undergoing an online course essentially focussed at bringing in an awareness of regulations and a sense of public responsibility. The course should be certified by the DGCA or the QCI and should be followed by an online examination leading to authorisation. The current regulation of mandatory training at authorised training organisations should be relaxed to make it an option for this category of operations.

30.3 The online examination should be conducted at authorised centres through professional organisations with the necessary infrastructure and expertise to bring in the desired level of quality in the process.

30.4 The blanket scrapping of licensing for UAS pilots also needs to be reviewed. In fact, licensing needs to be made essential for Category D operations for appropriate risk mitigation. Category C operations could be allowed to follow the current regulation wherein the pilot has to undergo formal training at an authorised institute followed by issuance of a certificate which allows the pilot to undertake Category C operations. Inter alia, this would require development of suitable course curricula leading to the certification or licensing of remote pilots associated with these operations.

31. Insurance

31.1 The emerging field of UAS operations will inevitably lead to incidents and accidents despite all efforts to minimise the same. This may lead to some sections of society demanding unjust limits on UAS operations quoting such accidents. Some of these concerns may also be genuine and can be mitigated through appropriate insurance mechanisms.

31.2 However, being a nascent industry there are inadequate norms for insurance of life and property adversely affected by UAS operations. There is good reason to seek at least third party insurance for all UAS operations. Insurance products for UAS themselves or UAS operators would also need to be evolved to provide enhanced encouragement to the fledgling industry.

32. Coordination and Control

32.1 There are multiple stakeholders involved in attaining the desired end state of UAS operations. Accordingly, all stakeholders need to attain consensus and their activities need to be coordinated.

32.2 There is equally the need for coordination amongst various agencies responsible for ensuring that the safety and security challenges emanating from UAS operations are kept within acceptable limits. In case any stakeholder is confirmed to be involved in wilful violation of the stipulated limits, there would also be a need for law enforcement and taking appropriate punitive action.

32.3 Another need would be to review the extant limits and regulations with the aim of ensuring their optimal adoption and suitable integration of emerging technologies that may enable greater efficiency in UAS operations.

32.4 All these activities demand creation of an empowered central body responsible for overseeing the evolution and implementation of appropriate UAS regulations based on the graduated approach contained in this paper as also coordination amongst all stakeholders to attain the requisite level of efficiency and effectiveness.

Conclusion

33. India has, arguably, been following a one size fits all approach in the implementation of UAS policy in India which has yielded success, albeit limited, in the recent past. However, multiple infrastructural and policy constraints remain which get accentuated as drone technology grows at an exponential rate.

34. An effective 'Concept of Operations' will help us lay down a clear roadmap not only for policy but also associated infrastructural growth and development so that we can optimize adoption of UAS for national growth and economic benefits of our society.

35. It is imperative that we adopt a paradigm shift in our extant approach in regulating a new age and rapidly evolving industry. We need to introduce graduated regulations proportionate to the risk as also which enable immediate requirements to be fulfilled without compromising the long term growth or safety requirements of UAS operations.