RES MILITARIS
REVUE EUROPEENNE D ETUDES EUROPEAN JOURNAL OF MILITARY STUDIES
Social Science Journal

Integration of Drones/UAV in Civil Aviation airspace in India: Challenges and Job complexities

By

Aishwarya Ashesh Pandey
Research Scholar Institute of Management studies Banaras Hindu University, Varanasi, Uttar Pradesh

Dr. Rajkiran Prabhakar
Assistant Professor Institute of Management studies Banaras Hindu University Varanasi, Uttar Pradesh

Abstract

Drones/UAVs, today offer many functions in the civil domain apart from their military usage. Drones' operations will increase significantly in the future. Drone Rules 2021 was formulated to promote the production, usage, and application of drones in India. Regulatory provisions are placed in to ensure prior information of drone operation and to regulate airspace for drone usage through categorization of airspace. This enhances the safety of flight operations and reduces conflict between drones and normal air traffic. This approach limits the usage of drones. Therefore, integration of UAV/drones in civil airspace is required to optimize their usage. The seamless integration not only requires technological complexity but is also essential to reduce the job complexity and stress of air traffic controllers and pilots. The introduction of drone operations augments the existing job complexity and stress of ATC and pilots as it increases the associated risks and is unpredictable.

Keywords: Drone, Unmanned Aerial Vehicles (UAV), Airspace, Instrument Flight Rules (IFR), Visual Flight Rules (VFR)

Introduction

Drones offer great potential and are beneficial for many sectors of the economy like – agriculture, mining, infrastructure, surveillance, emergency response, transportation, geospatial mapping, defence and law enforcement etc. Drones can be instrumental in enhancing creation of employment and can catalyze economic growth due to their penetrability, versatile usage especially in India's remote and inaccessible areas. There is huge potential of drone operations in India due to higher domestic demand and India's traditional strengths in innovation, information technology, frugal engineering. India may become global drone hub in recent future.

As there is constant increase in the use of small, unmanned aircraft systems, there is growing requirement of regulatory framework and operating procedure to ensure safe drone operations. Accordingly, there are worldwide efforts to develop a standard UAS (unmanned aircraft system) traffic management (UTM) system, including its operational concepts and regulations. The Ministry of Civil Aviation had published Drone Rules 2021 the regulatory ecosystem for progressive usage of drones in India was outlined.

Salient features of Drone Rules 2021

The salient features of Drone Rules 2021 are as follows:

Classification of drones

Drones shall be classified based upon the maximum all-up weight including payload as under

S.No.	Nomenclature	Weight Limit
1	Nano drone	Less than or equal to 250 gram
2	Micro drone	Greater than 250 grams and less than or equal to 2 kilograms
3	Small drone	Greater than 2 kilograms and less than or equal to 25 kilograms
4	Medium drone	Greater than 25 kilograms and less than or equal to 150 kilograms
5	Large drone	Greater than 150 kilograms

Mandatory safety features

The Central Government shall notify safety features to be installed on a drone by the person owning the drone. All persons owning a drone shall adopt the said safety features within such period as may be specified by the Central Government, which shall not be less than six months from the date of such notification. Such safety features that may be notified in the future, may include under

(a) No Permission – No Takeoff' (NPNT) hardware and firmware;
(b) Real-time tracking beacon that communicates the drone's location altitude, speed, and unique identification number; and
(c) Geo-fencing capability

- No flight permission is required up to 400 feet in green zones and up to 200 feet in the area between 8 and 12 km from the airport perimeter.
- No pilot license is required for micro drones (for non-commercial use), nano drones, and for R&D organizations.
- No requirement of a certificate of airworthiness, unique identification number, prior permission, and remote pilot license for R&D entities.
- Coverage of drones under Drone Rules, 2021 increased from 300 kg to 500 kg. This will cover drone taxis also.
- Issuance of Certificate of Airworthiness delegated to Quality Council of India and certification entities authorized by it.
- Drone corridors will be developed for cargo deliveries.
- Drone promotion council to be set up to facilitate a business-friendly regulatory regime.

Integration of Drone operations in civil airspace

Apart from their widespread use in the military, there is a massive market for UAVs in the civilian sector. Today drones are utilized for numerous purposes. They are currently used in agriculture, disaster management, land survey (Swamitva Mission), geo mining etc. apart from national security and defence needs. During Covid -19 outbreak, Drones were used for the disbursal of medicines and food items. Many e-commerce companies like Amazon, Flipkart etc. are planning to use UAV/ Drones for the delivery of their merchandise. Consequent to their anticipated enhanced use, UAVs are being manufactured in ever-increasing numbers and are improving rapidly in capability.

According to industry forecaster Teal Group, it is expected that by 2022, the global annual spending in this field on research and development will rise to $11.6 billion, from the current figure of $5.2 billion. The total investment by then would be over $89 billion and rising rapidly.

Due to the current uses of drones in present and anticipated increased applicability in near future, the provision for assimilation of drone airspace into civil airspace is essential.

Continuing demand for the use of Unmanned Aircraft Systems (UAS) and their diverse applications has put increasing pressure on the integration of drone operations in civil airspace. The need for operating UAS in the civil airspace to carry out tasks vital to national security, agriculture, emergency management, and science is increasing at a rapid pace

Categorization of Civil airspace

India being a member of the International Civil Aviation Organization (ICAO), adopts the standards recommended by ICAO through its Annexes. In India, Airports Authority of India is the entity responsible for civil airspace management.

Civil airspace is generally classified on the basis of types of flights eligible to fly and the services offers to flights.

Flights are planned on basis of following two rules governed by meteorological conditions under which they have to be flown:

Visual Flight Rules (VFR)

Flight to be flown under good weather conditions & at visibility 5 km or more. In these conditions the responsibility of terrain clearance and separation of one flight with another lies with individual flights.

Instrument Flight Rules (IFR)

Flights utilize onboard & ground-based instruments for navigation hence flight may be flown in low visibility conditions also**.** In these conditions the responsibility of terrain clearance and separation of one flight with another lies with respective air traffic control.

Airspace classification in India

Based on the permissible flight and type of service offered, the classification of Indian airspace is illustrated in as below:

S.NO.	Type of Airspace	Subject to Air traffic control	Designated Airspace	Two-way RT Contact Requirement
1	A, B,C, D	IFR and VFR flights are subject to Air traffic control	Area in vicinity of aerodromes, major aerodromes & Busy routes with heavy traffic density	Two-way RT contact required for both IFR & VFR
2	E	Only IFR flights are subject to air traffic control and will be given traffic information about another flight	Flight routes mainly used for heavy aircraft at high altitude	Two-way RT contact required for only IFR
3	F , G	Traffic advisory will be provided to IFR flights only	Less used airspace away from airports.	Two-way RT contact required for only IFR

Current Unmanned Aircraft Traffic Management System (UTMS) in India

Drone/UAV operation in civil airspace in India is at its nascent stage so currently the drone operation in India is governed by two basic principles:

Prior notification of Operation

Regulatory provisions have been made to ensure that drone operations in designated zones will be notified to appropriate agency before initiation.

Separation of Airspace

The airspace of India has been segregated in different zones to reduce conflict of drone operation with flight operation. Some area have been prohibited for drone operation and others are subjected to prior information & clearances.

Existing UTMS limits the usage of drone to limited airspace and impacts the dynamicity of drone operations. To optimize drone usage and operations effective integration of UAV in civil airspace needs to be done.

Challenges in assimilation of drone operation with civil airspace

Integration of UAVs into the existing Civil Airspace implies that they can fly safely in public airspace without disrupting the normal flow of air traffic in and around airports and on designated flight routes. Operation of drones with air traffic possess numerous challenges which have to be resolved for safety of both drone and aircraft. As stated above, the flights in India operate either under IFR or VFR at a time. Drone operations can undergo likewise either under IFR or VFR, the operations of drones under both conditions and their associated Job complexities are as under.

Drone operation under Visual Flight condition

In Visual Flight Rules (VFR), the pilots of aircraft basically see & fly and they are responsible for maintaining sufficient clearances from terrain and with other flights so the VFR operation possess less job complexities for Air traffic controller and more to the pilots. As drone/UAV are pilotless and the remote pilot associated with operation cannot have realistic visual observation and can only relay instructions and control signals. Hence in case of drone, VFR operations will be reduced to Line of Sight (LOS) operation. So Drone/UAV operation have to be treated as IFR operation.

Drone operation under Instrument flight conditions

As in case of IFR, it is mainly the responsibility of Air Traffic Control (ATC) to maintain terrain clearance & separation from one aircraft with another therefore there are certain conditions to be fulfilled for any aircraft to fly under IFR which are as under:

1. Two-way R/T Contact with Air Traffic Control (ATC) needs to be mandatory.
2. Position, level & speed of the aircraft needed to be known to Air Traffic control all the time during the flight.
3. The link between remote pilot and drone/UAV and control center needs to be continuous and without fail.
4. Transponder system on board for traffic collision avoidance system.

The safety in Aviation is achieved through standardized procedures, knowledge of roles and responsibility and flight operations are performed with precision and without any assumption. Drone operations involved an element of chaos and uncertainty which enhanced undue stress and complexity for Air traffic controller and pilots. Even with segregated airspace

and prior notification requirements, the uncertainty associated with drone operation increases the risks.

Drones/UAV being newer technology and without human interface to connect with, creates doubt and lack of control in air traffic controllers which will increase their stress level and enhance their job complexity.

Future Scope of Study

There are some areas over which further deliberation and research is required for seamless integration of drone operation into civil airspace.

Firstly, UAV needs to be classified according to their capability to operate in different classes of airspace.

Secondly, after due deliberation, the enhanced separation criteria for operation of UAV with other aircraft needs to be formulated and implemented.

Thirdly, restructuring of airspace needs to be carried out to accommodate drone operations without affecting safety of flights.

Fourthly, the emergency and degraded mode of operations for UAV/drone needs to be standardized.

Conclusion

Drones/UAV have multiple applications and there will be significant increase in drone operations in near future. Drones Rules 2021 have been placed to promote drone usage and to ensure safety of aviation through mandatory information/clearances and demarcation of airspace to regulate operation of drone in designated airspace. Existing regulations and traffic management system limits the application of drones. To enhance drone usage it is essential that drone can be operated with normal flights without disrupting normal flow of air traffic in major parts of country. Integration of UAV in civil airspace requires technological competence and regulatory support. Introduction of drone operation in civil airspace enhance the stress and job complexity in existing air traffic management system as it brings element of unpredictability in the system. Proper steps needs to be taken to standardize the procedures of drone operation along with technological requirements to minimize the associated risks and unpredictability to ensure safe aircraft operations.

References

Air Line Pilots Association. (2015). Remotely piloted aircraft systems: Challenges for safe integration into civil airspace [White paper]. Retrieved from https://www.alpa.org/-/media/ALPA/Files/pdfs/news-events/white-papers/uas-white-paper.pdf?la=en

DiFelici, J., & Wargo, C. (2016). UAS Safety Planning and Contingency Assessment and Advisory Research. Integrated Communications Navigation and Surveillance (ICNS) IEEE. IEEE.

eAIP India. (n.d.). eAIP India. Retrieved September 1, 2022, from https://aim-india.aai.aero/eaip/

Erzberger, H. (2004). Transforming the NAS: The Next Generation Air Traffic Control System. NASA Ames Research Center.

European Aviation Safety Agency (EASA). (2015). Concept of Operations for Drones: A risk based approach to regulation of unmanned aircraft. European Aviation Safety Agency (EASA).

European Aviation Safety Agency (EASA). (2015). Technical Opinion: Introductory of a regulatory framework for the operation of unmanned aircraft. European Aviation Safety Agency (EASA).

Federal Aviation Administration. (2007, February 6). 14 CFR Part 91: Unmanned aircraft operations in the National Airspace System. Retrieved from https://www.govinfo.gov/content/pkg/FR-2007-02-13/pdf/E7-2402.pdf

ICAO, 2001, Annex 11 to the Convention on International Civil Aviation: Air Traffic Services, Thirteenth Edition, Chapter 2, Section 2.6 and Appendix 4 to the Annex

Matt Grote, Aliaksei Pilko, James Scanlan, Tom Cherrett, Janet Dickinson, Angela Smith, Andrew Oakey, Greg Marsden, Sharing airspace with Uncrewed Aerial Vehicles (UAVs): Views of the General Aviation (GA) community, Journal of Air Transport Management, Volume 102, 2022, 102218,ISSN 0969-6997,

Report ITU-R M.2204 Characteristics and spectrum considerations for sense and avoid systems use on unmanned aircraft systems

Retrieved September 1, 2022, from http://tealgroup. com/index.php/about-teal-group-corporation/ press-releases/94-2013-uav-press-release

Retrieved September 1, 2022, from https://egazette.nic.in/WriteReadData/2021/229221.pdf

Retrieved September 1, 2022, from https://pib.gov.in/PressReleasePage.aspx?PRID=1749154

Retrieved September 1, 2022, from https://www.insightsonindia.com/2022/02/04/drone-rules-2021/