Rethinking 'Air Power' for the Governance of Unmanned Aerial Vehicles in India

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The exponential progress in technological innovation and its consequent applications over the last two decades has hastened the 'fourth industrial revolution'. The extraordinary pace of technological advances is leading to the merging of 'the physical, digital, and biological worlds in ways that create both huge promise and potential peril'.[1] The promise and peril identified here manifest in several systems such as advanced robotics, automation, and machine-to-machine communication. One such system is unmanned aerial vehicles (UAVs) with drones being a significant type. A UAV is an aircraft that operates either remotely or on another aircraft without a human operator on-board, comprising of an operating system to allow for communication between components, control of sensors, navigation, avionics and communication.[2] UAVs can be categorised in different ways on the basis of their function (autonomous weapons systems, semi-autonomous weapons systems, and supervised autonomous weapons systems) or architecture (fixed-wing, rotary-wing, and blimps).[3] They have emerged as unique technological products and platforms with a wide range of use cases, for military and

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non-military purposes. In the military, UAVs have been used for wireless military networks and information, surveillance, target acquisition, and reconnaissance missions (ISTAR).[4] Civilian applications of drones comprise their deployment for delivery of goods like transporting medical supplies during COVID-19, surveillance, search and rescue operations, managing borders, crime management, weather monitoring, precision agriculture, and infrastructure inspection.[5]

Despite having several military and commercial applications, UAVs have been used first and foremost for military purposes, globally and also in India. In the Indian context, widespread use of UAVs has been limited to three sectors—security (for both military and law enforcement functions), infrastructure (for construction, geospatial surveys—for land development and planning such as mapping uninhabited areas under the SVAMITVA scheme[6]), and agriculture (for crop surveys and crop spraying).[7] Given the primacy of their security sector applications, UAVs have been governed by regulations since their induction into the field, and make them tools of 'air power' or 'aerospace power'. This commentary analyses the connection between UAVs and 'air/ aerospace power'. First, the classifications of UAVs are discussed and existing governance and regulatory frameworks for UAVs are analysed in the context of 'air/ aerospace power'. Second, the existing definition of 'air power' is examined and its evolution from 'air' to 'aerospace' is traced in the Indian context. Finally, the argument is laid out for further refining the definition of 'air/aerospace power' given the variable applicability of UAVs for both military and civilian functions.

The 'What' and 'How' of UAVs

To take a nuanced approach to governance and regulation of UAVs, it is important to understand the various types of UAVs and their applications. A glimpse into the current regulations in the US and EU will provide insights for building aerospace-related rules for UAVs in India. Drones comprise the main type of unmanned systems in the domain of UAVs. Classifying UAVs is difficult due to their application in multiple domains. Few factors of classification are on the basis of size, performance specifications like weight, endurance, range, speed, wing loading, cost, engine type, and power; and mission objectives (such as ISTAR, aerial supply/delivery, or communication).[8] Military UAVs can also comprise: micro aerial vehicles used for surveillance, armed attacks, rescue operations, and transportation; local area support vehicles weighing up to 25 kgs; tactical area support

vehicles weighing 130–1300 kgs for real-time imaging; and theatre area vehicles piloted from a distance, of large size weighing 900–15,000 kgs.[9]

The use of UAVs offer benefits of operational flexibility on the basis of costs, platforms, time, and repeatability for remote sensing and mapping as compared to satellite or manned operations.[10] However, their operation involves safety risks—risk to human life due to collisions or impact on ground,[11] privacy risks, and impact on liability, environment, and security.[12] The foremost focus of the regulations for UAVs in the United States (US) and Europe is on safety. There are no specific guidelines for managing privacy in the US, and the General Data Protection Regulation (GDPR) in Europe is an overarching framework for protecting privacy and rights of subjects whose personal data is collected.

According to the US Federal Aviation Administration (FAA), airspace restrictions for UAS include stadiums and sporting events, near airports, security sensitive areas such as military bases, national landmarks (like Statue of Liberty), critical infrastructure like nuclear power plants, restricted or special use airspace, and the national capital region in Washington DC.[13] Any domestic operations for Department of Defense (DoD) with services outside of the airspace specified by FAA, the user has to comply with regulations of FAA and the Federal, State, and local law.[14] In addition, the regulations underscore safety in operation of UAVs with remote identification to allow UAVs to share identification, location, and performance information for people on ground and airspace users.[15]

The US does not have an official classification system for unmanned systems that operate in orbit or space. However, the National Aeronautics and Space Administration (NASA) has an informal classification for spacecraft, based on the end-use or function performed. NASA notes that it 'arbitrarily designates eight broad classes of robotic spacecraft according to the missions [they] are intended to perform'.[16] These eight types include flyby, orbiter, atmospheric, lander, penetrator, rover, observatory, and communications and navigation spacecraft. This informal categorisation has been created in order to convey complex information on varied robotic or unmanned systems in accessible form largely for educational purposes. Nevertheless, this classification system is informative and helps distinguish between aircraft and spacecraft. This is a crucial distinction that we will revisit in the next section.

Drones are allowed to operate in Europe after registration with European Union Aviation Safety Agency (EASA) with relevant open categories (A1, A2, A3) based on weights (ranging from 250 gms to 4 kgs), speed (maximum 42

mph for category A1), and minimum distance from people/crowds. Recent regulations in the EU have developed a U-space concept as a specific set of services and procedures for automated management and integration of UASs ensuring safe and efficient access to airspace.[17] With the deployment of this system, it would be important to highlight that air space restrictions and permissions are based on military and civilian applications.

In India, the Directorate General of Civil Aviation (DGCA) is responsible for drone safety and the Ministry of Civil Aviation proposed the Drone Rules in 2021 that apply to UASs which were later amended in 2022. UASs in India are classified as airplane, rotorcraft, and hybrid UASs, which can be remotely piloted, model remotely piloted or are unmanned.[18] They are further classified on the basis of their weight and payload as nano, micro, small, medium, and large UASs ranging from less than 250 gms to more than 150 kgs.[19] Red, yellow, and green zones have been specified as per the rules with an airspace map[20] for flying restrictions.[21] The red zone comprises airspace above territorial land or waters of India in which drone operations only by the Central government is permitted. While no permission is required for drones to operate in the green zone with an airspace that extends up to a vertical distance of 400 ft, air traffic control permission is required for yellow zones.

Additionally, it is important to distinguish between technical specifications compliance and operational rules and regulations. The former apply to R&D, manufacturing, and quality assurance of UAVs/drones as products, whereas the latter are applicable to the use and operation of UAVs by end-users. This piece focuses specifically on the use-case/operational rules and regulations for UAVs, within the context of 'air power'.

Ad Astra: From 'Air' to 'Aerospace'

Historically, the term 'air power' implies a nation's military capability for operations involving use of aircraft or missiles. With the expansion of operations of aircraft and missiles, and advent of satellite communications, the overall idea of 'air power' has slowly but surely evolved into the broader realm of 'aerospace'. The latter has become a term more widely used since the mid-2000s, to define the military capability of a nation in terms of air power. In the Indian context, 'air power' is defined using a couple of factors in the Indian Air Force's basic doctrine of 2012. First, air power is 'the ability to project military force by or from a platform in the third dimension above the surface of the earth'.[22] Second, it is defined not only as a means or medium

of transit, but also as a medium for 'manoeuvre, surprise, concealment, and deployment'.[23] The 2012 document elaborated that 'air power' comprised 'air forces, air arms, and civil aviation and their associated infrastructure, organisation, logistics, and personnel'.[24] It is important to note that civil aviation is defined as one of the constituent components of 'air power'. This is significant as UAVs find several applications that fall under the authority of civil aviation. Lastly, the 2012 basic doctrine also acknowledged the rise of the term 'aerospace power' to capture the broadened and interdependent domains of air and space.

The 2022 updated doctrine of the Indian Air Force recognises that the transition from 'air' to 'aerospace' has occurred due to the addition of space as a dimension of 'air power'. Emphasising the unity of air and space as a continuum, it notes that 'aerospace power' has core characteristics distinct from 'air power', as previously described. These characteristics include 'reach, flexibility, mobility, responsiveness, offensive lethality, and trans-domain operational capability'.[25] The most important distinguishing characteristic is trans-domain operational capability. Not least because the scientific laws governing the physical medium of air, and the vacuum of space are quite different, but because technology and its applicability differ as a result for air and space (as independent, yet overlapping dimensions).

The simplest example of this is the vast difference in speed (and therefore amount of energy and mode of delivery) required for sub-orbital, low Earth orbit, and orbital launches. Sub-orbital launch requires a speed of approximately 6,000 km/hr, which is roughly only 13 per cent of the speed required for an orbital launch.[26] This leads to huge differentials in the amount of energy required, and impacts efficiency and capability of the platforms employed. For the most part, sub-orbital platforms like satellites for communication, survey, and imaging purposes have been in operation since the earliest definitions of 'air power' were drawn up. UAVs serve as important sub-orbital platforms where their functions range from hyperspectral imaging and storm tracking to telecommunications relay.[27] They also have the potential to be applied in orbital and outer space use cases. This leads to UAVs existing in a unique liminality between 'air' and 'aerospace', where their current applications exist mostly in the realm of air, with the potential to expand into the space domain.

Furthermore, certain systems like orbiters, deep space probes, and surface rovers already function as unmanned vehicles. Depending on their particular purpose, such as surface soil and topography analysis for rovers, imaging and aerial surveying for orbiters, and hyperspectral imaging for

probes, each platform is designed for partial or full operational autonomy. Given their varied functions, these systems bring the term 'aerial' in unmanned aerial vehicles into question. This does not imply that surface, underwater, or underground drones cannot fit the definition of these systems. Notwithstanding these other categories, such unmanned systems (orbiters, probes, and rovers)—by dint of being used/transported in the medium of air (specifically planetary atmospheres), or space (in planetary orbit or inter-planetary loci) would normally be grouped as UAVs based on India's previous and existing definitions of air and aerospace power. The question to be asked in these cases—where unmanned systems or craft find application in the unified continuum of air and space as well as on terrain—is whether only 'aerial' can be used to describe these unmanned systems, especially when surface, penetrator, or robotic craft might be more apt terms.

Consequently, this highlights the critical need to review the definition of 'air power' or 'aerospace power', and reinforces the necessity of a more nuanced approach. There are ways to include these systems within the ambit of aerospace power, with the adoption of new terms and more varied classification systems. The term to focus on, for unmanned systems in India that have air and/or space trans-domain operational capability, could be 'spacecraft' or 'aerospace craft'. NASA's informal classification for spacecraft (refer Section 2) can be a starting point to inform India's own classification system for unmanned crafts with sub-orbital, orbital or outer space use cases.

Given the expansion of 'air power' into the realm of 'aerospace', and the introduction of UAVs into this realm, reviewing the definition of 'air power' is crucial. UAVs are uniquely placed not only in terms of air/aerospace power, but also in terms of cross-domain military and civilian functions. Governance of UAVs, therefore, needs to factor in this liminality. This foregrounds the need to take a nuanced approach towards rules, regulations, or policy for UAVs.

The Military and Policing Divergence

Having found application for military purposes as well as policing and law enforcement functions, UAVs are an important technological tool for militaries (including paramilitary) and police forces. While it would be natural to think that collectively these functions be grouped under the overall heading of security, it is crucial to remember that territorial security

or guarding against external threats and domestic/internal security are distinct in both style and scale of operations. This is especially important in light of the fact that given the complex nature of security operations, operational regulation and data-sharing are important issues for both armed forces and police.

Additionally, civilian uses of UAVs can range from commercial uses such as for event photography, to administrative uses such as land surveys and mapping, to potential security-based uses such as infrastructure inspection and surveillance. Some of these functions such as inspection and surveillance, overlap with those of military and police forces. Owing to this wide range of applications of UAVs, it is important to factor in the user and their operational use of UAVs, when formulating rules and regulations for the same.

Currently, the Drone Rules administered by DGCA specifically state that they do not apply to 'unmanned aircraft systems belonging to, or used by, the naval, military or air forces of India'. This can be reasonably interpreted to mean the armed forces and all other paramilitary forces. The concerning aspect is the lack of mention of police forces in the Drone Rules and whether they apply to them or not. This issue has been highlighted over the past couple of years,[28] especially since the grant of a 'conditional exemption'[29] from the Unmanned Aircraft System Rules 2021 to all Ministry of Home Affairs (MHA) entities. While the Drone Rules 2021 superseded the UAS Rules, the MHA is yet to release their own set of rules, draft or otherwise for operation of UAVs/drones by all entities under MHA, specifically police forces.

Way Forward

The Indian government has taken steps to adopt and use UAVs for both military and non-military purposes. Drones will be a key catalyst in providing a fillip to the economy with recent schemes like the Drone Shakti Initiative for start-ups introduced in 2022 to develop domestic drone manufacturing and boost investment in the sector.[30] Given these developments, ensuring adaptive governance of UAVs by revisiting guidelines and regulations, as well as expanding the scope of air/aerospace power to include the evolving applications of UAVs is the main policy recommendation of this commentary. The US and EU have made strides in building UAV regulations that can be capitalised on for rethinking air/aerospace power in both military and civilian contexts. Since there are overlaps in the military, law enforcement, and

civilian functions of UAVs, it is imperative to take a more nuanced approach for safe and efficient adoption.

For example, articulating subtle differences in UAV operation and jurisdiction for functions common to armed forces and police forces such as surveillance is important—which would entail provisions for differentiating cross-border surveillance as a military function, and urban/ traffic surveillance as a policing function. This would be the first step for more robust operational regulation. Further, the Ministries of Civil Aviation, Home Affairs, and Defence could come together to delineate their jurisdiction and functions, and bolster the same through specific rules for their respective UAV operations. This will help prevent multiplicity of rules for governing civilian, police, and military UAV use, while expanding the definition and practice of 'air/aerospace power'.

Notes

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