Emerging Role of Drones in Indian Defence System: From Surveillance to Strategic Autonomy

[1]Mr. Abhishek Naik, [2]Lieutenant Ashish Kumar Agarwal, [3]Mr. Prabhat Kishor Mahanand

[1]M.A in Political Science, Rajendra University Prajnya Vihar, Balangir

[2]HOD, Dpt. of Computer Science, Sonepur College, Sonepur ANO, NCC, Bn 11 Odisha, Balangir

[3]M.A in Political Science Rajendra University Prajnya Vihar, Balangir

Mail- mahanandprabhat@gmail.com

Abstract

The rapid evolution of unmanned aerial vehicles or UAVs commonly known as drones, has transformed the global defence and security landscape. From surveillance and reconnaissance to precision strike and logistics, drones are emerging as indispensable assets in India's military strategy. The Indian armed forces have progressively integrated UAVs for border monitoring, counter-insurgency operations, maritime patrol, and humanitarian missions. India has responded with a dual approach like procuring advanced foreign platforms, such as long-endurance UAVs, to bridge immediate capability gaps, while simultaneously fostering indigenous innovation through initiatives like Atmanirbhar Bharat and public–private partnerships. Recent demonstrations at defence expos, including indigenous counter-drone systems and medium-altitude long-endurance prototypes, highlight the growing maturity of the domestic ecosystem. However, challenges remain in areas such as secure communications, artificial intelligence–driven autonomy, and regulatory harmonization. This article examines the multifaceted role of drones in India's defence strategy, evaluates counter-drone policy frameworks, and identifies critical gaps that must be addressed to achieve operational readiness and strategic autonomy in the evolving domain of unmanned warfare.

Key Words: UAVs, Drone Warfare, Counter-Drone Systems, Indian Defence Strategy

1. Introduction

The evolving sophistication UAVs commonly known as DRONES, have fundamentally transformed contemporary defence paradigms. India's military has progressively integrated UAVs across a spectrum of operations. These include persistent surveillance along the Line of Actual Control and maritime zones, precision strike capabilities in counter-insurgency and border conflict scenarios, and logistical support in terrain-constrained areas. India has moved swiftly to operationalize indigenous counter-UAS systems. Notably, at Aero India 2025, Adani Defence & Aerospace, in collaboration with DRDO, unveiled a state-of-the-art vehicle-mounted counter-drone system featuring integrated detection, classification, and neutralization technologies such as high-energy lasers, 7.62 mm guns, radar, SIGINT, EO/IR sensors, jammers all consolidated into a mobile 4×4 platform with a 10 km engagement

range, the Bhargavastra anti-drone system and the VTOL-capable Rudrastra. The growing private-sector innovation is complemented by high-ambition government-backed efforts. Flying Wedge Defence & Aerospace's Kaala Bhairav, an AI-powered MALE combat drone boasting 30-hour endurance and swarm-strike capability, represents a potent stride toward strategic autonomy with significantly lower cost thresholds compared to imported counterparts. Concurrently, the Akashteer AI-enabled, fully automated air-defence control and reporting system demonstrated near-perfect efficacy in thwarting drone and missile threats during Operation Sindoor, reinforcing confidence in indigenous AI-driven command and control frameworks. This convergence of tactical utility and innovative defence-industry partnerships, underpinned by Make-in-India policies and Production-Linked Incentive (PLI) schemes. Therefore, this article aims to examine the dynamic and expanding role of drones in India's defence strategy by addressing their operational utility across surveillance, strike, logistics, and humanitarian operations. It's evaluating the growth of indigenous drone development and counter-drone innovations and analyzing the technological, and regulatory challenges that shape India's path toward strategic autonomy in unmanned systems.

2. Historical Analysis of the Drone Use in India

The trajectory of UAV development and adoption in India reflects both global technological trends and the country's evolving defence requirements. While drone technology was pioneered during the Cold War era by the United States and Israel, India began seriously exploring UAVs in the early 1990s, largely in response to operational gaps exposed during regional conflicts. Here are the historical analysis of Drone use in India. India's first major UAV acquisitions came in the mid-1990s, when the Indian Army and Air Force procured Israeli Searcher Mark-I UAVs, followed by more advanced Searcher-II and Heron UAVs in the early 2000s (Tellis, 2004). These platforms were primarily used for reconnaissance, target acquisition, and surveillance in conflict zones such as Jammu and Kashmir and along the Line of Control (LoC) with Pakistan. The Kargil War of 1999 was a watershed moment in highlighting the value of UAVs. By the early 2000s, UAVs had become a regular feature in India's counter-insurgency and border surveillance operations. The Indian Navy also adopted UAVs for maritime patrol and coastal surveillance, particularly to monitor piracy routes and safeguard energy lifelines in the Indian Ocean. Parallelly, India's Defence Research and Development Organisation (DRDO) launched indigenous UAV projects such as the Nishant and later the Rustom series (DRDO Annual Report, 2012).

In the past decade, India's interest in UAVs expanded from reconnaissance to include armed drones, loitering munitions, and swarm technologies. This was partly influenced by the global trend of combat UAV deployment in Afghanistan, Iraq, and Syria, and partly by the 2019 Balakot air strikes, which demonstrated the need for precision targeting and persistent surveillance. At the same time, threats from hostile drone use intensified. For instance, the 2021 drone attack on the Jammu Air Force Station underscored the vulnerabilities of military installations to low-cost UAVs, catalysing investment in counter-drone technologies (Raman, 2021). Since 2020, India has accelerated its UAV roadmap under the Atmanirbhar Bharat Abhiyan. Policies now emphasize restrictions on imports, incentives for domestic R&D, and

support for private sector and start-up participation in defence manufacturing. Programmes such as Nagastra-1 loitering munition, Kaala Bhairav combat UAV, and Akashteer AI-enabled air defence system mark a decisive transition toward building a comprehensive indigenous ecosystem for both UAV and counter-UAV capabilities. Defence expos like Aero India 2023 and 2025 have showcased India's readiness to integrate AI, swarm tactics, and indigenous manufacturing into its UAV strategy, signaling a new phase of operational autonomy (MoD, 2023).

3. Regulatory And Policy Context

India's regulatory framework for drones has evolved significantly over the last decade. It's reflecting the dual imperative of promoting innovation while safeguarding national security. The introduction of the Drone Rules, 2021, marked a watershed moment in harmonizing civilian UAV operations with broader strategic concerns. These rules simplified licensing requirements, reduced compliance burdens, and established the Digital Sky platform as a single-window system for registration, airspace management, and permissions, thereby encouraging commercial adoption while maintaining oversight (DGCA, 2021).The regulatory framework has strategic implications for the defence sector. By restricting indiscriminate imports of drones and critical sub-systems, the Government of India has sought to reduce external dependence and nurture a domestic UAV ecosystem. This aligns with the Atmanirbhar Bharat Abhiyan which emphasizes indigenous research, production, and technology transfers in the aerospace and defence sectors (Mehta, 2022). Drones designed for agriculture, logistics, or industrial mapping often incorporate components such as navigation systems, high-resolution cameras, and AI software that are equally applicable to defence use. The government has encouraged public–private partnerships and the participation of start-ups in defence tenders, creating a channel for civilian innovation to flow into military applications (IDSA, 2023).

4. Current Role of Drones In Indian Defence

The UAVs have become an indispensable part of India's defence architecture, offering critical support in surveillance, combat, logistics, and naval operations. Their role has expanded significantly in response to evolving security threats from both conventional adversaries and non-state actors. Drones are extensively deployed along the Line of Control (LoC) with Pakistan and the Line of Actual Control (LAC) with China for real-time monitoring and intelligence gathering. During the Kargil War of 1999, India employed Searcher UAVs to track enemy positions in the rugged terrain, marking one of the earliest operational uses of drones in active conflict (Tellis, 2020). In recent years, UAVs have been vital in monitoring infiltration attempts and ceasefire violations along the LoC, particularly after the 2016 Uri attack and the 2019 Pulwama-Balakot crisis (Pant & Joshi, 2021). While India initially relied on Israeli drones like the Heron and Searcher series for surveillance, it has increasingly focused on armed UAVs. The Indian military has acquired Heron TP armed drones from Israel and is finalizing procurement of MQ-9B Predator drones from the United States under a $3 billion deal, which will enhance precision strike capability (Singh, 2023). These systems provide strategic reach, enabling India to carry out surgical strikes and deep-strike missions

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without risking pilot lives. In 2021, the Indian Army tested indigenous drone systems to deliver essential supplies, including food, ammunition, and medical kits, to soldiers stationed at forward posts (Bhatnagar, 2021). Such applications significantly reduce risks to human carriers in hostile zones. The Indian Navy has adopted UAVs for maritime surveillance and reconnaissance across the Indian Ocean Region, where monitoring Chinese naval movements is a strategic imperative. The leasing of MQ-9B Sea Guardian drones from the U.S. has provided India with long-endurance ISR (Intelligence, Surveillance, and Reconnaissance) capabilities over vast oceanic stretches (Ministry of Defence, 2022).

5. Drones In Indian Operational Practice: Pahalgam Response and Operation Sindoor

In the early May 7–8, 2025, India executed Operation Sindoor, a rapid and precision-guided military response to the brutal Pahalgam terror attack of April 22, 2025, which claimed 27 lives. This operation showcased remarkable integration of drone warfare and air defense in a complex tri-service operation involving the Army, Air Force, and Navy. The Indian Air Force carried out a 23-minute strike, targeting nine terrorist infrastructure sites across Pakistan and Pakistan-occupied Jammu and Kashmir centers linked to Jaish-e-Mohammed and Lashkar-e-Taiba. India emphasized that these were narrow, non-escalatory strikes aimed exclusively at terror assets, with no intent to inflict civilian damage or cross into contested airspace.These included camps in Bahawalpur, Muridke, Muzaffarabad, and Kotli. Mobile Harop loitering munitions suicide drones were instrumental in neutralizing radar installations and site defenses before the main strike.The mission reportedly eliminated over 100 terrorists, reinforcing the efficacy of drone-enabled precision targeting.India's air defense transitioned swiftly to full operational readiness, deploying over 1,000 anti-aircraft guns, 750 short- and medium-range SAM systems, and systems like the Akash and Akashteer integrated through the Integrated Air Command and Control System (IACCS). These forces successfully intercepted and downed over 600 Pakistani drones, ensuring zero civilian harm. Assembling these rapid-response capabilities required exceptional readiness, effective ISR assets and centralized command via IACCS and Akashteer systems. Operational success was validated by civilian protection and strategic restraint, signaling India's technological maturity in unmanned warfare.

6. Case Studies of India's Drone Advancement

India's UAV and counter-UAV ecosystem has shown significant operational and technological maturity in recent years. At recent Aero India exhibitions, DRDO in collaboration with industry partners like Adani Defence & Aerospace demonstrated operational vehicle-mounted C-UAS platforms capable of detecting, tracking, and neutralizing hostile drones. These mobile systems integrate radar, electro-optical signal intelligence, jammers, and even kinetic weapons for layered defense. The demonstrations indicate a transition from experimental prototypes to deployable, operational systems, reflecting India's growing ability to secure critical infrastructure and military installations against UAV threats (Adani, 2025). India's private sector and public–private consortia have showcased medium-altitude long-endurance (MALE) combat drones equipped with AI-based

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navigation, swarm coordination, and precision strike capabilities. Notable examples include Kaala Bhairav and other long-endurance prototypes demonstrated at defence expos, capable of 30+ hour flight durations and integrated targeting systems. These initiatives highlight a strategic shift toward cost-effective, domestically produced combat UAVs, reducing reliance on imported platforms while expanding India's operational autonomy (Economic Times, 2025). Expansion of production facilities by private defence firms to meet military requirements. Integration of AI and autonomous technologies in surveillance, strike, and swarm operations. Increased DRDO-industry collaboration, signaling India's commitment to bridging the gap between R&D and operational deployment.

7. Counter-Drone Challenges and Responses

The rapid proliferation of commercially available drones both rotary-wing and fixed-wing has introduced a new class of asymmetric threats to India's security environment. These platforms are low-cost, portable, and increasingly capable of carrying ISR, payloads or even explosive munitions, making them attractive tools for terrorist groups, insurgents, and non-state actors (IDSA, 2023). Advanced capabilities, such as GPS spoofing, encrypted communications, and swarm deployment, further complicate detection and neutralization. Even a small swarm of drones can overwhelm conventional radar and air-defence networks, creating vulnerabilities in critical areas. Energy and transport installations, including ports, airports, and pipelines. The 2021 drone attack on the Jammu Air Force Station exemplified these vulnerabilities, highlighting the operational and tactical risks posed by low-cost UAVs in coordinated attacks (Raman, 2021).In response, India has been developing a multi-layered C-UAS strategy encompassing detection, neutralization, and integration with existing defence networks such as Detection and Tracking: Integration of radar, electro-optical/infrared (EO/IR) sensors, and signal intelligence (SIGINT) to identify drones across varying altitudes and speeds. Mobile and fixed installations capable of rapid deployment near sensitive areas. Electronic Warfare (EW): Jamming communication and GPS signals to disable hostile UAVs. Kinetic Measures: Small arms, anti-drone missiles, and directed-energy weapons for swarm or persistent threats. Vehicle-mounted C-UAS systems developed by DRDO in collaboration with private industry, demonstrating operational readiness at Aero India exhibitions (Adani, 2025). Incorporation of C-UAS assets into Integrated Air Command and Control Systems (IACCS) for rapid threat assessment and coordinated response. Real-time intelligence sharing between Army, Air Force, and paramilitary forces to mitigate asymmetric drone threats.

8. Policy Recommendations: Practical And Prioritized Measures

After the overall study we analyzed the evolving dynamics of drones in Indian defence, it is clear that while India has made significant strides in UAV deployment, counter-drone systems, and indigenous innovation, the rapid proliferation of drone technologies necessitates robust, forward-looking policy interventions. The following recommendations are practical, prioritized, and aligned with India's strategic imperatives are discussed below.

i)Strengthening Indigenous Development: India's drone ecosystem is moving from import dependence to domestic capability, yet gaps remain in long-endurance MALE drones, AI-enabled targeting, and swarm systems. Policies like Expand DRDO–industry partnerships,

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providing seed funding and procurement guarantees to start-ups and SMEs focused on UAV innovation (IDSA, 2023). Promote domestic production of critical components such as high-resolution EO/IR sensors, guidance systems, and secure communication links to reduce reliance on foreign suppliers (Pant & Joshi, 2021).

ii) Develop a Comprehensive Counter-Drone Doctrine: The threat landscape has evolved with cheap commercial drones, swarm attacks, and GPS spoofing posing serious asymmetric risks. India must work on the field of Institutionalized layered C-UAS systems at sensitive military installations, borders, urban centers, and critical infrastructure (Adani, 2025). Integrate C-UAS assets within IACCS and tri-service command structures to enable rapid detection, response, and neutralization of threats.

iii)Modernize Regulatory and Procurement Frameworks: India's Drone Rules (2021) and DAP 2020 have established foundational policy, but enhancements are needed to balance security, innovation, and operational efficiency. Fast-track approvals for military-grade UAVs and dual-use technologies to accelerate deployment. Establish a national UAV registry for both civilian and defence sectors to ensure accountability and traceability of all drones operating in India's airspace.

iv) Promote Strategic and Regional Cooperation: UAVs are no longer purely tactical tools; they are instruments of geopolitical influence such as collaboration with Israel, the U.S., and France on technology transfers and joint R&D for combat UAVs and C-UAS systems. Establish regional counter-drone agreements with SAARC and Quad nations to share best practices, threat intelligence, and interoperability standards. Participate in international forums on drone ethics, autonomous warfare, and export controls to ensure India shapes global UAV norms rather than simply reacting.

9. **Conclusion**

From early reconnaissance UAVs in Kargil to Operation Sindoor, India has effectively leveraged drones for high-impact, low-risk operations, demonstrating operational and technological maturity.The evolution of drones in Indian defence reflects a paradigm shift in modern warfare, where unmanned systems are now central to surveillance, precision strikes, and multi-domain operations. While commercially available drones introduce asymmetric threats including ISR by non-state actors, swarms, and GPS spoofing India's response through C-UAS systems, AI-enabled combat UAVs, and layered air defense highlights strategic foresight and self-reliance. Policies promoting indigenous development, regulatory modernization, human capital, and regional cooperation are crucial to sustain operational readiness and domestic capability. The final essence drones have become force multipliers, shaping India's defence posture with precision, agility, and technological dominance. The integration of UAVs across land, air, and maritime domains ensures that India is not only responding to emerging threats but also positioning itself as a leader in autonomous and unmanned warfare in the Indo-Pacific. India's Advanced Drones technology not only helps in the defect to Enemy attack but is used in various sectors to protect the civilian. Thus the emerging Drones technology is really crucial for India's Defence System.

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