GARUDAKSHAK



Legal Regulation Guidelines and Limitations on  
 Anti-Drone Systems

*A Comprehensive Analysis of Indian Regulatory Framework  
 for Anti-Drone Technologies*

Prepared by :-

Divyanshu Saini

Student at Manipal University Jaipur

Date : 22/11/2024

**Introduction To Garudakshak: -**

GARUDAKSHAK is a highly advanced anti-drone solution which is designed for the assurance of airspace security through novel beam-tracking and electromagnetic web technologies. This weapon type detects, identifies, and intercepts the unmanned aerial system along with the help of some of the most aggressive algorithms and real-time RF data analysis and tracking mechanisms. General Method The objective of this method is to secure sensitive areas which include defense zones, government installations, and public areas from unmanned aerial systems.  
  
This advanced system of GARUDAKSHAK will classify friendly and hostile drones based on criteria, which are UINs, flight patterns, and no-go policy of India's "No Permission– No Take-off" system, making it right in the scope of the legal frameworks of India but also very smooth in protecting the airspace of the country.

**Indian Legal Regulations on Anti-Drone Systems: -**

India’s regulatory framework for drone operations and counter-drone systems is governed by the **Drone Rules, 2021**, under the **Aircraft Act, 1934**. These rules ensure safe, responsible usage and address the growing concerns around unauthorized drone operations. Anti-drone systems like GARUDAKSHAK must align with these legal requirements to ensure compliance while protecting airspace.

**1. Frequency Allocations**

Under the WPC wing of guidelines, drone flying in India should operate on specific ISM bands such as **2.4 GHz** and **5.8 GHz**, as interference with telecommunication and aviation signals must be avoided. The transmitter power of drones is capped at **100 mW EIRP** to prevent disturbances to licensed frequencies. GARUDAKSHAK should, therefore, design its detection and interception systems to operate within these frequency bands while ensuring no interference with other critical communications. ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)).

**2. Airspace Zones**

The Drone Rules, 2021, classify Indian airspace into three zones to regulate operations:

* **Red Zone**: Drones are not permitted to fly in the red zones without permission from the Central Government. This zone mainly includes airports, military zones, and other sensitive premises. GARUDAKSHAK is mainly entrusted with tracing unauthorized access in the red zones ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)).
* **Yellow Zone**: Permission from Air Traffic Control (ATC) is required for operations in this zone. Anti-drone systems deployed here must coordinate with ATC to ensure alignment with flight regulations ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)).
* **Green Zone**: Drones are allowed to operate freely up to 400 feet in this zone without prior approval. However, GARUDAKSHAK must monitor for unauthorized boundary violations, especially near sensitive zones ([Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf), SSRN Paper: "Analysis of Indian Drone Laws", [Link](https://ssrn.com/abstract=4817307" \t "_new)).

**3. Unique Identification Number (UIN)**

The **Digital Sky Platform** mandates every drone in India to be registered and issued a Unique Identification Number (UIN). This system allows authorities to trace drones in real-time and identify their ownership. GARUDAKSHAK must integrate with the UIN system to differentiate authorized drones from unauthorized ones ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)).

**4. NPNT Compliance**

India’s No Permission – No Take-off (NPNT) protocol requires drones to receive pre-flight approval through the Digital Sky Platform. GARUDAKSHAK can leverage NPNT compliance data to identify and intercept drones that are non-compliant ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)).

**5. Geofencing**

Geofencing technology, mandated under the **Drone Rules, 2021**, prevents drones from flying into restricted airspace by creating GPS-based boundaries. Anti-drone systems like GARUDAKSHAK must incorporate geofencing data to monitor and act on any breaches ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)).

**6. Remote Identification**

To ensure accountability, drones must broadcast their identity and flight details via Remote Identification Systems. GARUDAKSHAK can utilize these signals to cross-check authorization and flight paths ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), SSRN Paper: "Analysis of Indian Drone Laws", [Link](https://ssrn.com/abstract=4817307)).

**7. Privacy and Data Protection**

Data collected by drones or anti-drone systems must comply with Indian data protection regulations. Sensitive personal data captured by GARUDAKSHAK’s systems should be encrypted and anonymized to prevent privacy violations ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)).

**8. Penalties for Violations**

The **Drone Rules, 2021**, impose a penalty of up to ₹1,00,000 for unauthorized operations. GARUDAKSHAK’s reporting capabilities should assist authorities in identifying and penalizing violators effectively ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)

**9. Counter Drone Technology**

India permits certain counter-drone technologies under strict regulations:

* **Authorized Measures**: RF jamming, GPS spoofing, and physical capture methods such as nets.
* **Prohibited Measures**: EMP systems and unauthorized technologies that may disrupt civilian operations ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)).

**10. Incident Reporting**

The **Directorate General of Civil Aviation (DGCA)** mandates the reporting of all incidents involving drone or anti-drone operations. GARUDAKSHAK should have automated logging systems to ensure compliance with this requirement ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)).

**11. Integration with Digital Sky Platform**

GARUDAKSHAK must connect with the **Digital Sky Platform** to access real-time data, including UINs and NPNT approvals. This ensures that the system operates with up-to-date information about authorized drones and restricted zones ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)).

**12. Environmental and Noise Standards**

All counter-drone operations must minimize environmental impact and adhere to India’s noise pollution guidelines. GARUDAKSHAK should ensure low-noise operation and avoid ecological disturbances during deployment ([Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf), [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)).

**Key Considerations for GARUDAKSHAK: -**

**1. Integration with Regulatory Systems**

The GARUDAKSHAK should be integrated with the **Digital Sky Platform** so that in real-time, it may be able to receive the **UIN** and **NPNT compliance**. Thereafter, it should be able to identify registered drones and monitor for any unauthorized operations, as envisaged under the **Drone Rules, 2021**.  
This would be in consonance with the **Drone Rules, 2021**, so that no drone is flown inside restricted zones, including the **Red** and **Yellow Zones**. Utilizing **geo-fencing tools** would enable GARUDAKSHAK to monitor boundaries of airspace and ensure that drones stay within allowed limits in consonance with the classification of airspace as envisaged by the regulations.

**2. Conforming to Frequency Standards**

The system developed by GARUDAKSHAK should be within the range of **2.4 GHz to 5.8 GHz** specified by **ISM frequency bands** as per **Wireless Planning and Coordination guidelines**. Such licensed communication channels should not be disturbed since these channels are mostly used for aviation communications, telecommunication, and public safety channels of national importance.  
Keeping the **transmitter power** under **100 mW EIRP** ensures that the flight of GARUDAKSHAK complies with **WPC guidelines** as well as the **Drone Rules, 2021**, which state that drones may not interfere with critical communication systems.

**3. Adherence to Airspace Zone Regulations**

GARUDAKSHAK shall also have to abide by the airspace classification as envisaged through the **Drone Rules, 2021**. It shall not operate a drone in **Red Zones** without permission from the **Central Government**, and in **Yellow Zones**, it shall not operate without the permission of **ATC**.

The system should, therefore, be able to detect unauthorized drones in **Red Zones**, areas of high security such as airports or military zones, and **Yellow Zones** that require ATC approval, and intervene when necessary to comply with the regulatory framework.

**4. Data Privacy and Security Compliance**

GARUDAKSHAK should adhere to privacy provisions under **Indian laws**. Considering that the system collects information, which may include personal data related to drone operators and flight details, proper **anonymization** and **encryption techniques** must be adhered to so that the same can be protected under **Indian laws on privacy**.  
The **Drone Rules, 2021** will treat sensitive data related to operations with security and ensure that such captured data is compliant with privacy standards and shall not be misused.

Certainly! Here's the formatted version of the text with proper structure, while maintaining the original content:

**5. Counter-Drone Technology Limitations**

GARUDAKSHAK will operate under sanctioned technologies for the **Drone Rules, 2021**, and as guided by the government. In this case, **RF jamming** and **GPS spoofing** are the permitted technologies for anti-drone systems, while **kinetic interceptors** may comprise nets.  
The system should not use forbidden technologies like those that involve **EMP**, which could interrupt civilian communications or destroy installations, as the regulations prohibit such technologies.

Conclusion: -

By aligning its operations with these regulations, GARUDAKSHAK can ensure that its anti-drone technology operates effectively while maintaining compliance with India’s legal framework for drone operations. This alignment will be crucial for the system's success in managing airspace security without interfering with other essential services or violating legal norms.

**Bibliography: -**

1. **Press Information Bureau**. (2022). **Indian Drone Laws Analysis**. Retrieved from [Press Information Bureau](https://static.pib.gov.in/WriteReadData/specificdocs/documents/2022/jan/doc202212810701.pdf)
2. **Ministry of Civil Aviation**, Government of India. (2021). **Drone Rules, 2021**. Retrieved from [Directorate General of Civil Aviation](https://www.dgca.gov.in/digigov-portal/?page=jsp/dgca/InventoryList/RegulationGuidance/Rules/The%20Unmanned%20Aircraft%20System%20Rules/Drones%20Rules%202021.pdf)
3. **SSRN Paper**, "Analysis of Indian Drone Laws". (2024). Retrieved from [SSRN Paper: Analysis of Indian Drone Laws](https://ssrn.com/abstract=4817307)